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The Ingersoll Continuous Differential Type Milling Machine

This is the story of a great producer among machine tools, of a design that permits this machine to waste no precious moment of the working day by running with idle cutters. It is built with as many cutter spindles as the character of the work permits using to advantage

By J. V. HUNTER
Western Editor, *American Machinist*

THE past year or two has seen some wonderful developments in the creation of new types of machine tools, and among these the differential type of continuous milling machine stands out prominently because of its unusual design and production possibilities.

Most "new" machine tools are merely minor changes of existing designs, or modifications to meet certain conditions which are due to the varying character of the work which is to be performed. However, there are still pioneers in the machine-tool industry who keep it eternally progressing, and among these some firms have developed much that is really new in their respective fields. Many conditions confront a pioneering designer for which there are no precedents for his guidance. Consequently, what he develops requires the expenditure of far more thought, time and capital than does the mere matter of making minor changes in machines of accepted design.

Creation Brings Satisfaction

There is a degree of satisfaction in the production or creation of a machine-tool type that serves to compensate the designer who feels that in its creation he has to some extent accomplished a masterpiece. But the masterpiece of a designer, who thereby produces a machine which aids in lowering the cost of production, should bring a keen sense of satisfaction not only to the one who has accomplished such a result, but to all manufacturers in the machinery industry, as it aids in holding down the ever-rising labor cost of their product.

The Work of the Ingersoll Company

For years the Ingersoll Milling Machine Co., Rockford, Ill., has been building milling machines for many different purposes and treating the design of each one as an individual engineering proposition, to insure that it shall be suited in every particular for just that class of work for which it was designed. The large number of its milling machines, which are scattered throughout the manufacturing shops of the world today, bear ample testimony of the success of designing these tools from an engineering standpoint. This company's more recent efforts have been toward the development of a line of continuous milling machines, and its differential type of continuous milling machine, shown in the headpiece, will doubtless for some time stand out prominently among the Ingersoll productions. The reader studying the principal features of this machine will find little similarity between it and other existing types of machine tools. The differential machine is

essentially for continuous-milling operations; it may have a multitude of working stations, but has only one loading and unloading station, so that only one operator is required to control all of its motions and results.

The outstanding features of this machine tool are: First, its enormous capacity on relatively large pieces of work in connection with the minimum amount of floor space that it occupies; second, the small amount of labor required to attain this capacity, as only one operator is required for loading and unloading the work and the control of all its operations; third, the fact that it carries a large number of milling cutters, each of which may be arranged for simultaneous operation on different pieces of work so that there is no overlapping of the actual work performed.

In considering the essentials of this new machine, we find that it consists of two main parts which are shown in the sectional view, Fig. 1; the first of these is the lower or work-carrying table, and the second is the head carrying the milling-cutter spindles. Both of these revolve in the *same* direction. Therein lies the secret of the word differential, for this represents the difference in the relative speeds of the two parts, and this difference of speed constitutes the rate of feed of the cutters across the face of the work.

Vertically through the center of these two revolving parts is a large column about which the work table rotates, and which, in its turn, carries and drives the heavy spindle head. The head carries a number of spindles, the number varying with the character of the work for which the machine has been planned, but it is always one less than the number of work-holding fixtures which are carried upon the table. This permits the cutter spindles to be continuously operating at all times upon work; yet, leaves one fixture idle at the loading station, which permits the operator to remove and replace work in this fixture before it travels around into a working position.

The work-holding fixtures, such as are seen in the different illustrations, are designed especially for the job for which the machine is to be used. So carefully are these designed and fitted to the machine that they almost seem as though they were an integral part of it. Various fixtures are shown, but those in Fig. 2 are possibly a little easier to understand. This machine is fitted up for rough- and finish-milling the top of the cylinder blocks for the Fordson tractor engines. One of the work-holding fixtures is shown empty to give a better idea of the construction.

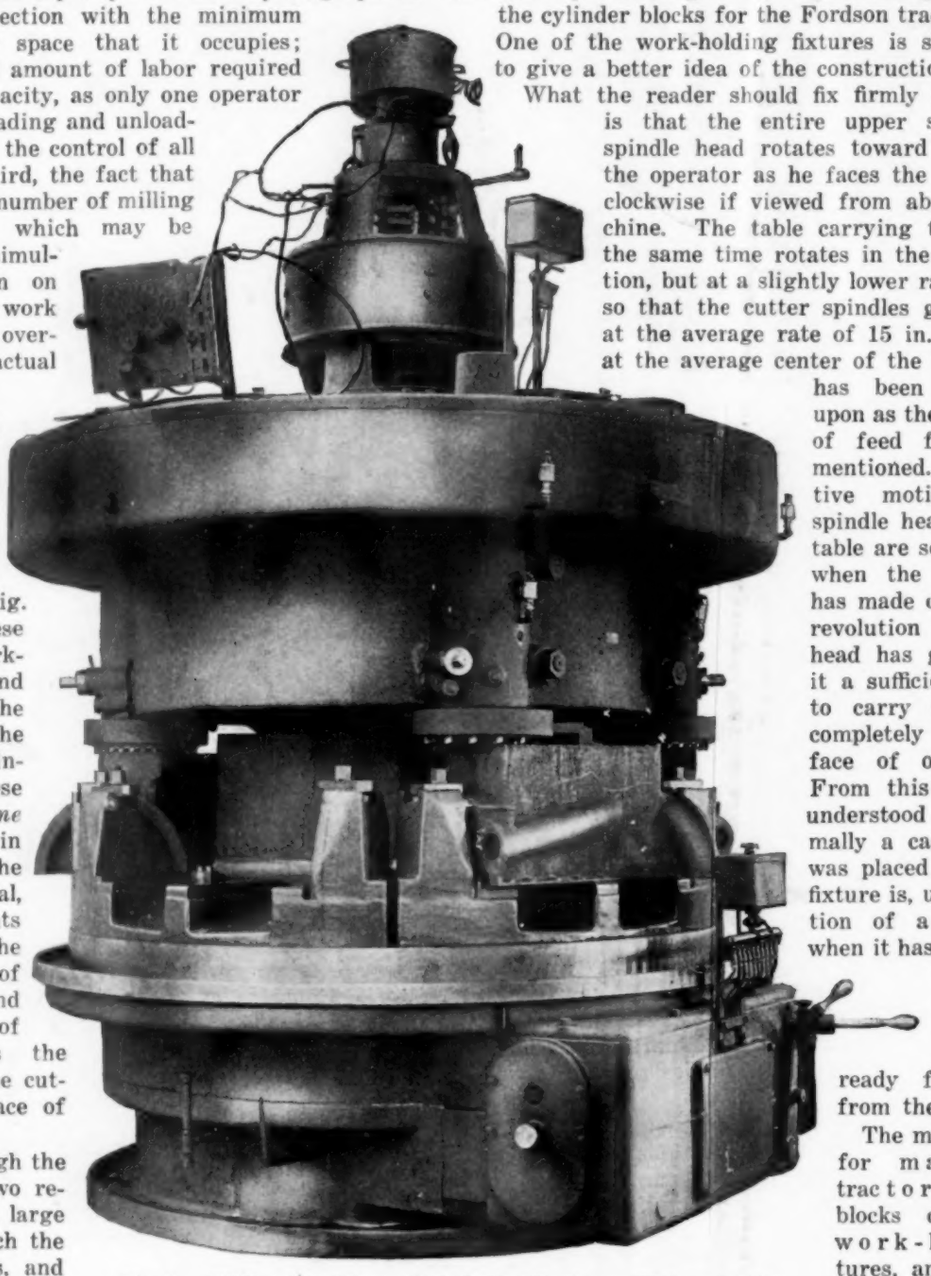

Fig. 2. Milling Top Face of Cylinder Blocks on 60-in. machine

What the reader should fix firmly in his mind is that the entire upper structure or spindle head rotates toward the left of the operator as he faces the machine, or clockwise if viewed from above the machine. The table carrying the work at the same time rotates in the same direction, but at a slightly lower rate of speed, so that the cutter spindles gain upon it at the average rate of 15 in. per minute at the average center of the work, which has been determined upon as the proper rate of feed for the job mentioned. The relative motion of the spindle head and work table are so timed that when the work table has made one complete revolution the spindle head has gained upon it a sufficient distance to carry one spindle completely across the face of one casting. From this it may be understood that normally a casting which was placed in any one fixture is, upon completion of a revolution, when it has returned to the loading station, entirely machined and ready for removal from the table.

The machine built for machining tractor-engine blocks carries five work-holding fixtures, and with one of these always passing through the neutral position at the loading station, there are four others holding work, upon which the cutters are operating. However, upon all of the machines used on engine-block work, it is advisable to take both a roughing and a finishing cut on the machined surfaces. Consequently, on this machine spindles carrying the roughing cutters followed by other spindles carrying the finishing cutters, must pass across the surface of each casting before it is ready to be unloaded, and since only one set of spindles passes the casting during a single revolution, it is therefore necessary for the table to make two complete revolutions before the cast-

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ing can be unloaded. Under these circumstances, the operator at the loading station removes one finished casting from alternate fixtures. Both the loading and unloading are performed by a single operator, who is never required to change his position on the floor.

The 80-in. machine, shown in Fig. 3, carries two roughing cutters at each of the two roughing cutter positions. These roughing cutters are approximately one-half of the diameter of the finishing cutters, the smaller sizes being used in place of a single cutter because the reduced diameter avoids the heavy torsional strain on the spindle which would occur with a single large-diameter cutter on rough work. All of these cutters are inclosed in heavy guards which protect them against danger to the operator, but are readily removed should it be desired at any time to replace a cutter. The character of the cutters is shown distinctly in the back view of this same machine, Fig. 4. On this machine there are two large finishing cutters, one of which is seen at *A*, and two sets of roughing cutters, one set being shown at *B*. These make a total of six cutters working at one time.

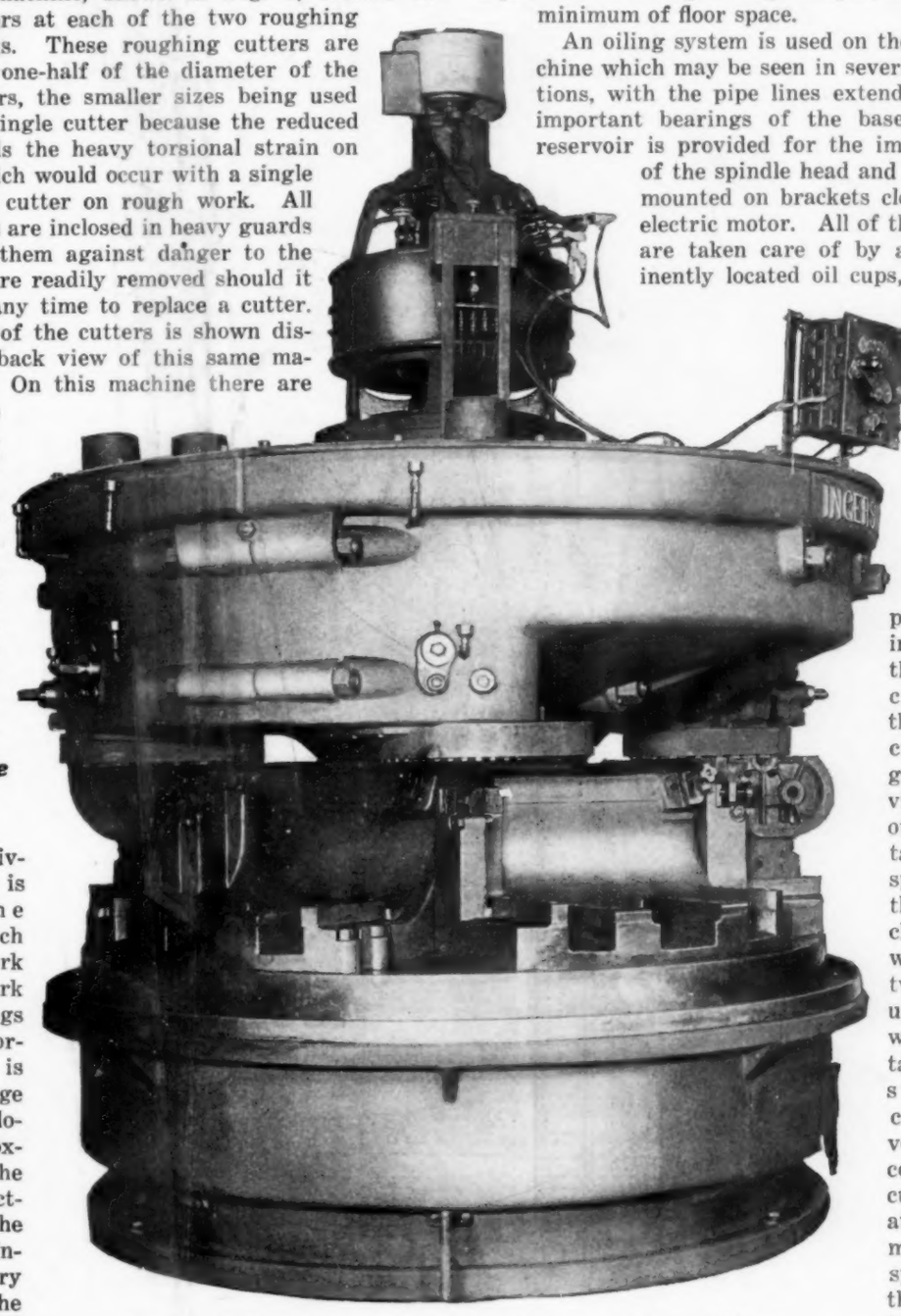


Fig. 3. Milling Bottoms of Cylinder Blocks on 80-in. Machine

Some of the Machine Details

The main driving mechanism is located in the heavy base which supports the work table. This work table has bearings similar to a boring mill, and is driven by a large worm gear located in the box-like section of the base seen projecting at *C*. The drive of the spindle head is very similar and the worm gear for this is located just below the table worm drive, and in turn it connects with the spindle head body casting by means of a heavy sleeve casting which surrounds the center column. The head casting is supported at the base of this sleeve by collar bearings of ample width to provide the necessary surface for the support of so heavy a part. The drive gears for the spindles are all hardened-steel gears and are inclosed in the upper revolving body casting.

All of the illustrations of the complete machine show the method of power drive by a vertical electric motor mounted above the center of the machine. This feature permits the drive shaft to extend through the center of the column to the base below and avoids encumbering valuable floor space. It is a noticeable feature of this machine that for a production unit capable of handling a large output, it still occupies a minimum of floor space.

An oiling system is used on the base of the machine which may be seen in several of the illustrations, with the pipe lines extending to all of the important bearings of the base. A similar oil reservoir is provided for the important bearings of the spindle head and this may be seen mounted on brackets close alongside the electric motor. All of the other bearings are taken care of by ample and prominently located oil cups, thus always insuring proper attention. The single lever *D*, which shows just below the lower oil reservoir, is practically the only control required for the 80-in. machine, other than that provided by starting and stopping the motor. This control lever throws in the clutch of the gearing that provides the rotation of both the work table and the spindle head. In the 60-in. machine, Fig. 2, it will be noted that two levers are used, one of which stops the table while the spindle carrier continues to revolve about the column, with the cutters still operating, thus permitting any spindle to reach the empty loading station when it is desired to remove a cutter. Each machine has been planned for a single purpose; consequently, there has been no necessity of providing elaborate gear-change mechanism to take care of a multitude of different requirements of speed, feed, etc., such as arise when a machine must be planned for general manufacturing purposes.

The number of spindles on the machines so far built have varied from four to seven. Regulation of the height of the spindles for the varying depths of cut is obtained by means of standard Ingersoll quills which

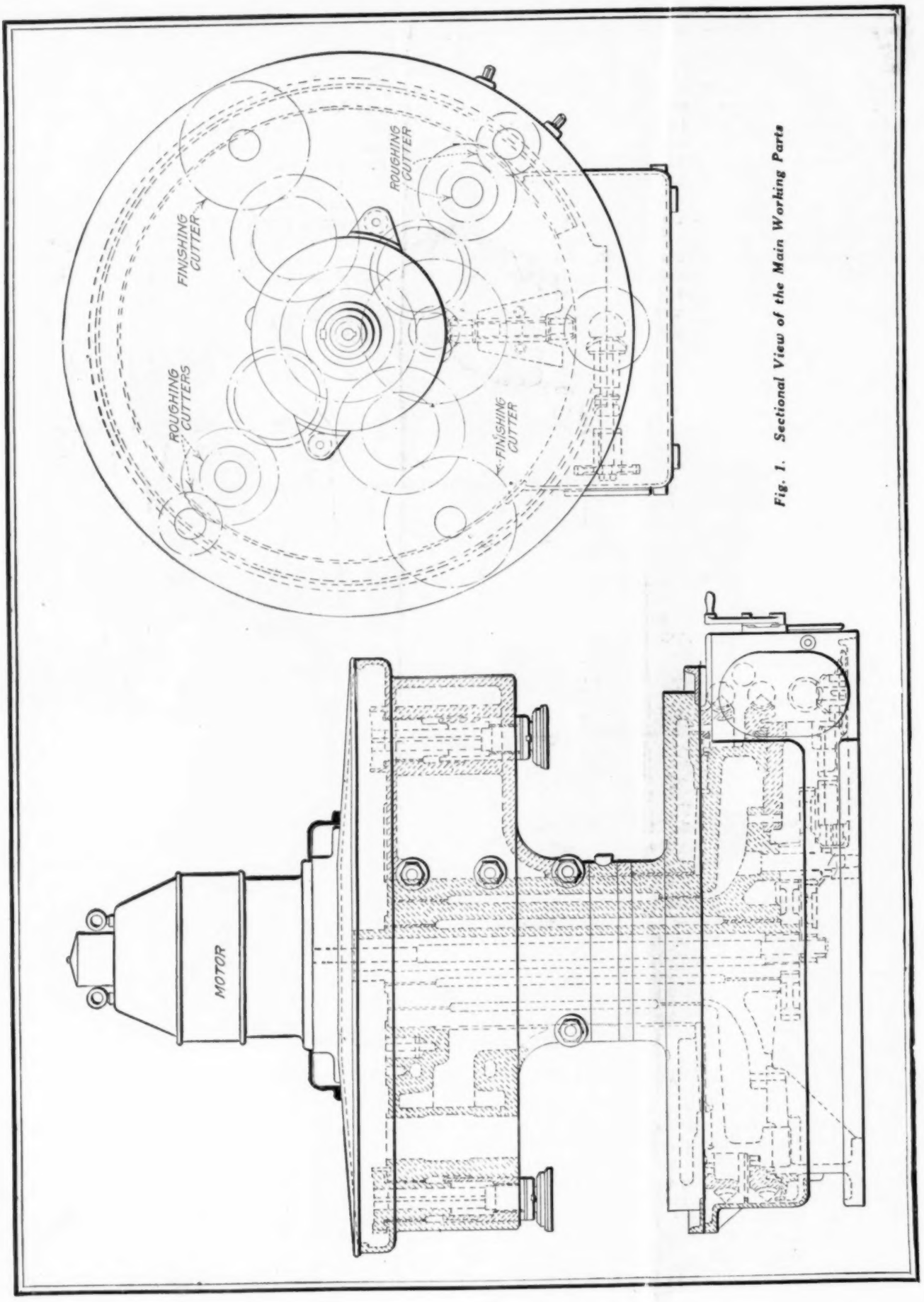


Fig. 1. Sectional View of the Main Working Parts

extend through the housing near the base of each spindle. These permit the operator to alter the depths of cut at will, to compensate for the wear or regrinding of any or all sets of cutters. Each spindle is provided with its individual adjustment of this character.

The features of this machine of especial interest to production engineers as previously noted are the minimum amount of floor space required, its great production possibilities, and the absence of any necessity on the part of the operator of attending any station other than that which has been called the loading station.

Installation System

The system which has been employed for the installation of one set of these milling machines in a large tractor-engine plant is shown in the floor layout, Fig. 5. Two of the differential-type of continuous milling machines are used in connection with a drilling machine and one Ingersoll drum-type continuous milling machine. The surfaces requiring milling on this casting are shown by the diagrams in Fig. 6; that on the left showing the surface plan of the cylinder base, and that on the right the surface plan at the head.

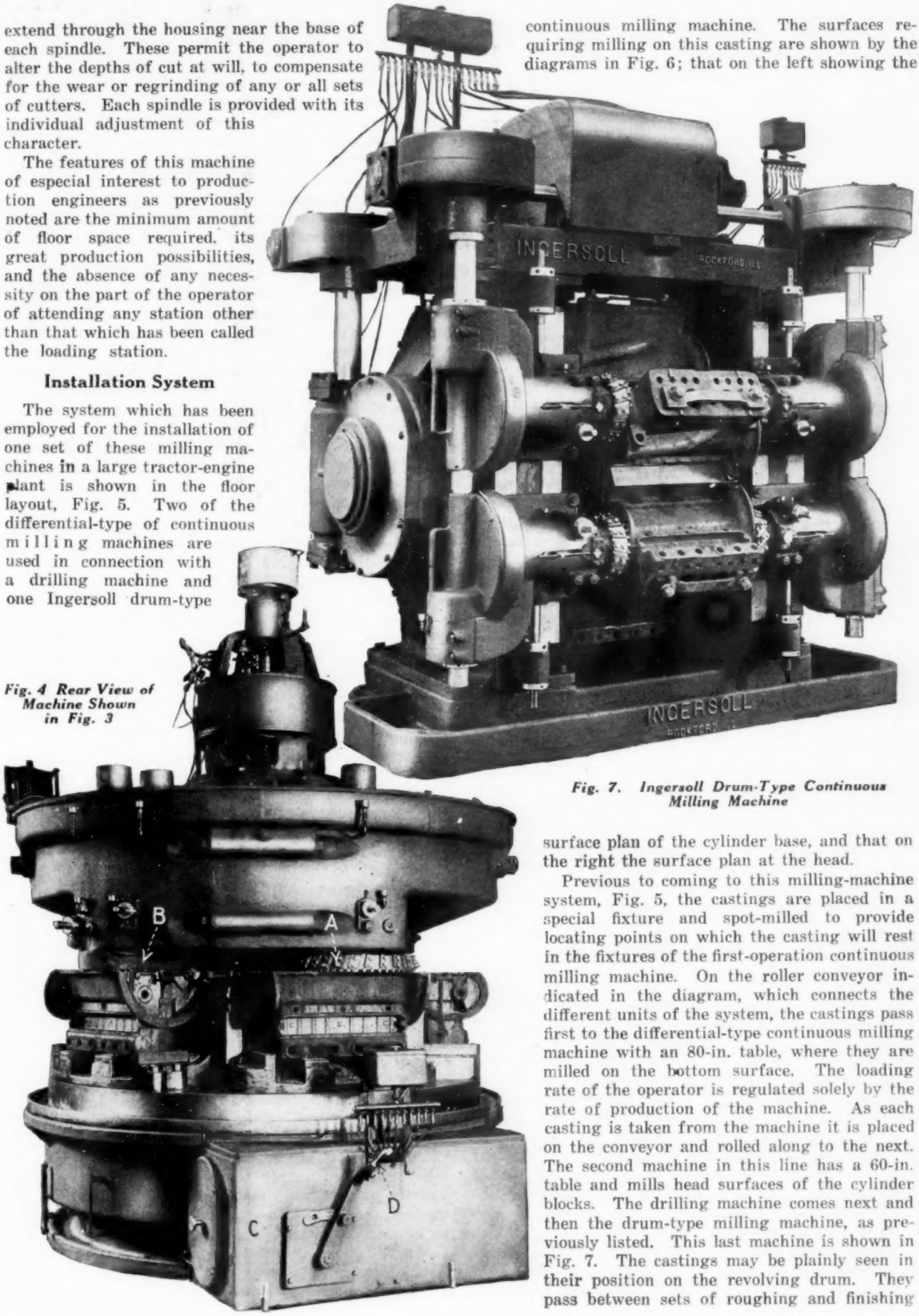


Fig. 4 Rear View of Machine Shown in Fig. 3

Fig. 7. Ingersoll Drum-Type Continuous Milling Machine

Previous to coming to this milling-machine system, Fig. 5, the castings are placed in a special fixture and spot-milled to provide locating points on which the casting will rest in the fixtures of the first-operation continuous milling machine. On the roller conveyor indicated in the diagram, which connects the different units of the system, the castings pass first to the differential-type continuous milling machine with an 80-in. table, where they are milled on the bottom surface. The loading rate of the operator is regulated solely by the rate of production of the machine. As each casting is taken from the machine it is placed on the conveyor and rolled along to the next. The second machine in this line has a 60-in. table and mills head surfaces of the cylinder blocks. The drilling machine comes next and then the drum-type milling machine, as previously listed. This last machine is shown in Fig. 7. The castings may be plainly seen in their position on the revolving drum. They pass between sets of roughing and finishing

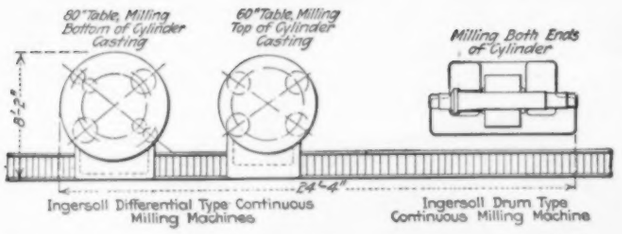

80" Table, Milling Bottom of Cylinder Casting
60" Table, Milling Top of Cylinder Casting
Milling Both Ends of Cylinder
8'-2"
24'-4"
Ingersoll Differential Type Continuous Milling Machines
Ingersoll Drum Type Continuous Milling Machine

Fig. 5. Floor Layout of a Continuous Milling Installation

cutters which finish the two ends. The small amount of floor space taken up by this complete unit is strikingly shown by the dimensions, indicated on the diagram, Fig. 5, which show that for the three milling machines indicated, together with the drilling machine, a total space of only 24 ft. 4 in. by 8 ft. 2 in. is required.

The two differential types of milling machines handle these castings at the rate of 200 per 8-hour period, or at the rate of one casting every 2 min. 24 sec. The

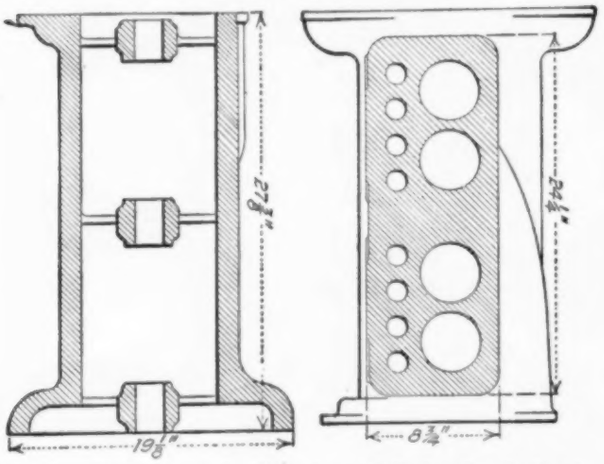


Fig. 6. Surfaces to Be Milled on Cylinder Block Casting

productive capacity of the drum-type machine is 240 milled castings per 8-hour period, so that it will be seen that with a higher production rate for the last machine of the series, there is little chance for congestion of any kind to occur in this production lineup. The first, or 80-in., machine in the unit weighs approximately 45,000 lb., and the second, or 60-in., approximately 35,000 pounds.

The Status of the School Shop

By J. B. Phillips

On page 122, *American Machinist*, W. D. Forbes makes reply to my former article on the "Status of the School-Shop Graduate." He infers that I am a professor; that a professor teaches what he has been taught, whereas, an instructor teaches out of his experience; and that the only competent teacher is of the latter type. My article was headed "Instructor in the Los Angeles State Normal School," but perhaps 30 years' practical experience in the machine shop previous to taking up school shop work eight years ago is not sufficiently long to place me in the preferred class.

We have been in school work long enough to overcome the unkind attitude toward "the professor" which is so frequently found in shop circles, and the sooner industrial and professional men withdraw from the Ancient Order of Hammersmiths the sooner we will be able to discuss some of the problems of mutual interest without feeling the sting of class prejudice.

We believe that men who read and think, could and should demolish the time-worn barriers that stand between the essential elements of society. We should hold in contempt the "high brow" who, because of his college title, ignores and belittles the unlettered artisan; and we should equally detest the ignorant jake who delights in waving the red flag every time a subject is broached that calls for thought or smacks of learning.

We have asked dozens of machinists within the last five years what trade journal they took, and invariably the answer has been, "I don't take any." We have then asked them what they thought of the broaching machine, and they did not know what we were talking about, clearly indicating their ignorance not only of this but of many other modern tools and appliances.

The educational level is constantly rising. The eight-hour day has arrived, and lack of ability or opportunity will no longer serve as an excuse for not knowing what men are saying and doing within specified trade limits; industrial heads should unite in urging upon workers the importance of reading their own trade journals.

The Federal Board of Education, working through the state and county boards, is seeking to make our public schools more and more efficient along the lines of trade skill and related technique. We are emerging from the pioneering stage into a well-defined policy of general helpfulness and race betterment. That which was originally intended for the schoolboy is destined to involve the reëducation of disabled soldiers, and also to reclaim for industry a substantial percentage of the vast army of men and women who are annually injured.

These schoolboys, ex-soldiers, and citizens will ere long be seeking admittance to industry, and in speaking of the status of the school shop we have asked what the school-shop graduate can reasonably expect at the hands of employers and tradesmen.

In discussing this question we must face present facts and not attempt to substitute ideals for realities. It would be ideal and altruistic to give an apprentice his journeyman papers after 12 months service if he qualified. But the fact is that the *average* apprentice *cannot* qualify in less than four years. Therefore, to apply a sliding scale to the term of indenture would be objected to under present conditions both by apprentices and by employers. This applies to the regular apprentice, but we are asking about the school-shop graduate. If, for instance, he is familiar with the lathe, drilling, shaping, and possibly the milling machine; understands their construction, knows the function of each part, and how to operate them with a degree of skill commensurate with his experience; if he can select, grind, and set the proper tool for the work involved, has a knowledge of cutting speeds and feeds for different metals, and is in a fair way to use precision instruments; should he not be given a time allowance as an apprentice? We admit that it is perfectly legitimate to demand that the boy demonstrate what he can do and thereby prove his claim; and lest he fall short of his claim we of the school shop are urging that commercial shop men define for us just what machines and tool processes the student should have a working knowledge of in order to be accredited 6, 12 or 18 months on his time.

We will close as before by asking three questions: Should time allowance be made for school-shop work? If so, how much? Who shall define the requirements?

The Use of Trade-Marks—I

By CHESLA C. SHERLOCK

The difference between a patent and a trade-mark is too often lost sight of. If you have never been up against this proposition you will probably be surprised to learn the attitude of the courts in such cases and also the utter lack of protection provided by some of our best-known trade-marks.

TRADE-MARKS, like patents, are of great interest to all manufacturers, for they denote rights which may be acquired by the inventor and patentee of a device, or a trade characteristic which may become extremely valuable in the process of distributing manufactured products.

The law of patents is much better understood by the average manufacturer than the law of trade-marks, because in the former instance he has been thoroughly schooled to protect his own interests. The use of trade-marks, however, arises through no such compulsory methods, often being deemed of slight value, or of having value only after long years of continual usage.

The United States Supreme Court has held that the term "trade-mark" has been used from a very early date, and means a distinctive mark of authority through which the products of a particular manufacturer, or the vendible commodities of a particular merchant, may be distinguished from those of others. It may consist of any symbol or form of words, but as its office is to point out distinctly the origin or ownership of the articles to which it is affixed, no sign or form of words may be appropriated as a valid trade-mark which, from the nature of the fact conveyed by its primary meaning, others may employ with equal truth for the same purpose.

These two quotations from the authorities on the subject should serve to fix in mind, first of all, the primary purpose of trade-marks. Manufacturers and others who have occasion to use trade-marks are not always conscious of this purpose.

In the first instance, a trade-mark is to denote the origin of the manufactured product, or ownership, which amounts to the same thing. And in the second place, the purpose is to distinguish the articles so marked from other articles of the same nature or purpose to aid the public in its buying, if it has any partiality at the time of purchase.

Too often it is supposed that a trade-mark is to serve a purpose not permitted at law; namely, to contain words or symbols descriptive of the quality, characteristics or ingredients of the article so marked.

Trade-Mark Subject Matter

It has been held again and again by the courts that any mark or device containing words or symbols descriptive of the quality, characteristics or ingredients of the article *is not the subject matter of a trade-mark.*

There is a reason for this holding, and when a comparison is made between trade-marks and patents, the distinction is at once apparent. In patents, the Government grants an absolute monopoly to the inventor for the use, manufacture and sale of the patented article for a period of 17 years.

This monopoly is granted to the inventor or his assignees because it is deemed necessary to preserve in the man of talent the fruits of his industry and skill, else the incentive to the promotion of the arts and trades, being removed, would seriously curtail industrial development.

A trade-mark is not a patent. The Government does not grant a monopoly upon the article sold or a monopoly upon the right of other persons to make a similar article with the same ingredients, because the fundamental purpose of a trade-mark is not monopoly but a means of distinguishing one article from another, so far as origin and manufacture are concerned.

Each person has a right to make certain general articles and sell them, all containing more or less the same ingredients. If a manufacturer were permitted by law to adopt a trade-mark signifying the ingredients, characteristics or quality of his article and hold a monopoly upon them against all other competitors making the same article, he would, in fact, have a patent upon the use of those words, which would give him an undue advantage over all competitors in his field.

Hence, this is not permissible at law because the right to use ingredients in the manufacture of an article and to use words in advertising them or offering them for sale is universal. The owner of a trade-mark, if permitted to use symbols and words descriptive of the quality, characteristics and ingredients of his article would assume the position of a patentee when he is not, in fact, entitled to it, having invented nothing or by his superior skill or application produced a property right upon which he should have governmental protection.

We have been in the habit of considering patents and trade-marks in the same chain of thought, hence it is not surprising that the average merchant or manufacturer should be so greatly surprised when he attempts to sue someone for infringement and finds that he, himself, has been without the pale of the law through all the years of his usage of an improper trade-mark.

Value of Trade-Marks

Trade-marks have a very valuable place in modern industrialism and their value may even exceed that of some of the most valuable patent rights, simply because they acquire a meaning in the mind of the purchasing public which oftentimes is worth more in an advertising way than a patent, lasting for a greater period of time and having value so long as they appear before the public.

But trade-marks may be as valueless as a "scrap of paper" if they fail to heed the legal bounds set out for them. There is no purpose served in trying to use a device contrary to law, because sooner or later an enterprising competitor will enter the field and adopt a similar device and succeed in winning in the courts, merely because in the first instance the original owner or user of the symbol forgot to look up the law or seek competent advice.

It is said that the trade-mark of a well-known brand of baking powder is valued in excess of $17,000,000. This is not unlikely and it only goes to show the great

cumulative value of a trade-mark when properly adopted and advertised through the years.

Suppose, now, that this baking-powder company had made the mistake of adopting a trade-mark describing in some way the quality, characteristics or ingredients of the powder sold. Some competitor anxious to capitalize their own publicity adopts a device calculated to deceive the public. The original company attempts to recover for infringement and finds that they have no recognized trade-mark because they have not kept within the bounds of the law. What is the result? The value of their trade-mark melts away in a few minutes and it is anybody's property from that time on.

For this very reason we urge upon manufacturers of machinery especially the necessity of carefully studying their own trade-marks again and being sure that they are built on a sound legal foundation before continuing their use for another moment. If they are found to be on the "border line," by all means change them at the earliest possible moment and do not devote the years to building up a confidence in the mind of the purchasing public for your article which may later be swept away in a few minutes.

The law will not deprive the public of the right to use a particular word and convey the privilege to another. But it is admitted that the manufacturer may originate words to fit his own product, or symbols, and make them the subject matter of a trade-mark, provided those original words or symbols do not signify the quality, characteristics or ingredients of the article which is offered for sale under them.

Some Court Decisions

In a New York case, it was held that for a word to be descriptive in such a sense as to preclude its use as a trade-mark, it must impart reasonably accurate information as to the general characteristics of the article to which it relates, or refer to quality or the ingredients thereof.

In a Federal case, however, it was held that "it is not essential to the validity of a trade-mark that it shall be utterly devoid of aptitude, but it is sufficient in this regard if it leaves open to the public all words that are really descriptive of the quality or character of the article the mark is used to designate."

Another Federal case holds that if a word is suggestive of the advantage to be gained in the use of the article or of some effect produced, and not merely descriptive of character, quality or ingredients, it may be the subject matter of a trade-mark.

It is interesting to note the English rule, which is that the mark and the words used must be meaningless so far as it concerns the designated article in order to be the subject matter of a trade-mark.

The rule that any device or symbol containing descriptive words as to quality, characteristics or ingredients cannot be the subject of a trade-mark, is subject to an important exception.

This exception is to the effect, as announced by a Federal case, that even though the word is descriptive in the prohibited sense at the time of its adoption, if it has, through long continued use acquired a secondary meaning designating it or the manufacturer thereof, it will be upheld as a trade-mark.

In Kentucky the court said that a trade-mark may contain descriptive words as to quality, characteristics or ingredients, but if it is used in combination with nondescriptive words, it may be sustained.

In the proper consideration of this subject it is not possible to convey the meaning underlying the court decisions unless quotations are made of actual cases where the court has had to decide whether certain words were the subject matter of trade-marks or not.

Examples of Illegal Trade-Marks

In the first place, the reader must keep in mind that the criterion by which the words were judged was whether or not they were descriptive of quality, characteristics or ingredients of the article. If so, they are not the subject of trade-marks. Therefore such words as are given below as being *descriptive* words are held not to be subject matter of trade-marks.

The following is a partial list of words held in actual cases not to be the subject matter of trade-marks, because they were descriptive:

Absorbine
Air brush
Air-cell—designating a fire-board
Air-cell—designating a fire-proof material
Aluminum
Always Closed—a type of door
Asbestos—designating engine and machinery packing
Astral—designating petroleum
Bazaar—designating clothing
Beeswax Oil
Beverwych—toilet paper
Black Package Tea
Bohemian—beer
Borax—a soap
Brassier—a corset
Brilliant—a flour
Bromo Quinine
Cachemire Milano—a fabric
Camel Hair—a belting
Castoria—a medicine
Cellular—cotton and woolen goods
Chain—tires
Chips—round disks of gum
Circular Loom—covering for electrical conductors
Classic—greeting cards
Climatic—paints
Clinton Hematite Red—paint
Compressed Yeast
Computing Standard—scales
Continental
Copper Clad—wire having copper covering
Crack Proof—rubber
Cream—as applied to both rolled oats and yeast
Cresylic—ointment containing that ingredient
Crystal—beer
Cushion—electric motor
Electro—a steel made by electric process
Eton—cigarettes
Famous—stoves
Gem—a gun
Goodyear
Gramophone—a sound reproducer
Granite—kitchen utensils
Hand Grenade—fire extinguisher (1886)
Home washer—a washing machine
Kantleek—rubber goods
League—baseballs
Magnolia—a metal
Malted Milk
Muffler
Naphtha
Norub
No Sag
Notaseme
Official—baseballs
Panoram—cameras
Paraffin
Porus Plasters
Purity—oleomargarin
Razor Steel
Rochsault—insect powder
Rubberoid—roofing material
Self-Loading—a cartridge
Shredded Whole Wheat
Shur-on—eye-glass frame
Siphon—a refrigerator
Snowflake—crackers
Spearmint
Standard—a pattern
Stayon—eye-glass frame
Stud—a belt fastener
Swing—scythe sockets
Thermogene—cotton wadding
Tobasco—pepper sauce
Uneeda—a biscuit
Use-Em-Up—a drill
Velvet—ice cream
Whirling Spray—a syringe
Wire Glass—a fireproof glass

The legal reasoning back of these decisions can be easily sustained by the average person, when these so-called trade-marks are considered in the light of the statute.

Suppose that we take "Shredded Whole Wheat" for

instance. Everyone is familiar with the extensive advertising carried on by this concern and with the great value the trade-mark of that name would convey to the corporation marketing the product. But because the combination of words used was so clearly "descriptive" the manufacturer cannot obtain the exclusive use of them to the exclusion of others. Had a combination of words been adopted at the time "Shredded Whole Wheat" was first placed upon the market, which was not descriptive, and as consistently advertised, it is needless to say that the manufacturer would have had a more tangible asset in the name than is now the case.

What is said here of "Shredded Whole Wheat" is merely by way of illustration and could be applied with equal force to any of the other words or combinations quoted above. The point is that the manufacturer, if he uses or wants to use a trade-mark at all, should carefully study the names rejected in the light of the judicial opinions and not make the mistake that has been made by others before him.

Trade-marks which are properly adopted unquestionably have a great commercial value and are worthy of adoption by any far-sighted business man. They are not merely an ornament as so many suppose, but they serve as a means of identification which is protected by the Government, so that the user thereof may not be subjected to unfair competition on the part of unscrupulous competitors. For this reason alone trade-marks have a practical value in any business, and particularly to manufacturers and machinists who are striving to produce a superior article which could so easily be imitated with the use of inferior ingredients and sold under fraud and deceit as being the identical article of the honest manufacturer.

What Is a High-Grade Machine?

The following letters give the impressions and convictions of leading machine-tool builders as to what constitutes a high-grade machine. Several of the replies to the editorial on this subject which appeared in the issue of Aug. 7, 1919, will appear as separate articles.

THE AMERICAN TOOL WORKS CO., CINCINNATI, OHIO

In my opinion a high-grade machine is one which is properly designed for strength, rigidity, convenience of operation and productivity, as well as being built out of thoroughly good material and with high-grade workmanship. In other words, a machine which is finished to produce in the greatest quantity, to stay in continuous service and not break down or get out of alignment readily, and to have a long life, is a high-grade machine.

J. B. DOAN, President and General Manager.

BARDONS & OLIVER, CLEVELAND, OHIO

I think the term "high grade" probably belongs in the same category with "wide belt," "very rigid," and so forth. We have always tried to steer clear of such expressions in our printed matter and in our correspondence. I, therefore, plead not guilty, and do not see why we should be penalized by being asked to define something that can be stretched as much as the term you refer to.

JOHN G. OLIVER.

BROWN & SHARPE MANUFACTURING CO., PROVIDENCE, R. I.

In the editorial referred to I think you took rather an unfortunate illustration in the automobile of the pleasure type. It is a well-known fact that the sale of automobiles oftentimes is determined by reason of the good lines or by the upholstering that a car possesses. Among people who know their business, of course, elements of wear and design and all those things that pertain to good engine work have their weight.

In the machine-tool business it seems to me that a high-grade machine consists of a machine that has well-proportioned bearings, good alignments, bearing and running surfaces that are made of material that will withstand the wear they are put to, and with it all must be given some attention to looks and to finish. I believe that it is very possible to overdo the finish on a machine, and in fact I believe that one is apt to look rather askance at a highly finished machine tool.

W. A. VIALL.

BRYANT CHUCKING GRINDER CO., SPRINGFIELD, VT.

The term "high-grade machine" in most of our minds conveys the idea of superior workmanship. My own idea of a high-grade machine is that it should show superiority in production and, of course, endurance, as well as stability in keeping with the duty required.

W. L. BRYANT, President.

THE FELLOWS GEAR SHAPER CO., SPRINGFIELD, VT.

The subject "What Is a High-Grade Machine?" is a rather difficult one to discuss for the reason that there are many factors entering into it. Properly speaking, a high-grade machine is one which gives satisfactory and reliable service to the owner. Price does not always indicate the grade of a product. The parallel in your editorial of an automobile and a machine tool brings out but one phase of the subject, and that is satisfactory service.

There is another phase, namely, that of accuracy, in which these two are not parallel. For instance, an automobile can be made with fairly wide tolerances on the parts and still give satisfactory service, providing it is made from good materials and properly assembled. Such is not the case with the machine tool that is used for accurate work. There are certain parts of machine tools in which wide tolerances would not only be objectionable, but would unfit the tool for the service for which it was intended.

About the simplest and shortest definition of the term "high-grade machine" would be that the machine is made from proper materials to withstand the service for which it is intended, and is made with a degree of accuracy which will fulfill the requirements of the work produced by it. In other words, if a manufacturer purchases a machine which he requires to be of first-class design and construction, he expects to receive a machine which will meet his requirements and give a reasonable amount of service without repairs.

DOUGLAS T. HAMILTON, Advertising Manager.

THE GEOMETRIC TOOL CO., NEW HAVEN, CONN.

My opinion as to what constitutes a high-grade machine is simply this: Any machine that is properly designed for the work it is intended to accomplish, is constructed from materials best suited to withstand the strain of operation and the performance of its work, and has its component parts well balanced and fitted in a manner that will reduce friction to the lowest possible limits under the highest practicable producing speed, is a high-grade machine.

It may not look as pretty nor be so ornamental as other machines having 17 coats of paint and seven coats of varnish, but I do not consider the exterior finish of a machine as being an essential part of a high-grade machine, nor do I consider that the price charged for a machine is a factor from which to judge its grade.

A machine may be constructed under most modern conditions by highly skilled mechanics, yet be improperly designed, or constructed from certain materials not best suited to withstand the speed or stress of operation. High polish and perfect workmanship cannot make it a high-grade machine any more than a silk hat and dress clothes make a gentleman. It is the true character in either the machine or man that makes for perfection regardless of the outer finish, clothes or polish.

HOWARD E. ADT, Treasurer and General Manager

GOULD & EBERHARDT, NEWARK, N. J.

We would define a high-grade machine as follows:

A machine that has been seasoned, that is, tried out and known to deliver the production it is represented to do, is a high-grade machine—one that will continue to do its work year in and year out, without going lame, or breaking

down, or requiring continual repairing. The machine must be well fitted and finished throughout and should be easy to manipulate and adjust.

FRED'K L. EBERHARDT, President and General Manager.

GREENFIELD TAP AND DIE CORPORATION, GREENFIELD, MASS.

A machine designed for specific work, producing the highest quality and greatest quantity, is what you might call "a high-grade machine."

I would state further that a high-grade machine in its broadest sense is the result of years of development whether it comes under the head of a standard or a special machine, so that, after all, the term is merely relative. It would seem, therefore, that this answer would apply to automobiles as well as to machine tools as has been already proved in the manufacture of automobiles.

F. G. ECHOLS, General Manager.

THE HENRY & WRIGHT MFG. CO., HARTFORD, CONN., U. S. A.

My definition of a high-grade machine is one in which every qualification is high. In the case of a metal-working machine this would mean such qualifications as: Quantity of output; quality of output; economy in use of power; economy in use of labor; economy in upkeep and use of floor space; quality of constructive material, workmanship, finish and design.

After all other points are judged, first cost should be considered, for the reason that it is possible to make a very high-grade machine in every one of the other respects and fail in a competitive sense on first cost, due to lack of good judgment in selection of materials or good management during construction or distribution.

Your question leads me to offer the suggestion that possibly an exhibition under the auspices of either some of the mechanical associations or some other reliable and competent body for the purpose of awarding medals and prizes for various degrees of excellence, might work out to very material advantage to both the producers and users of high-grade machinery.

D. M. WRIGHT.

KEARNEY & TRECKER CO., MILWAUKEE, WIS.

When speaking of a high-grade machine tool, I have in mind a machine constructed with extreme care and capable of producing very accurate work. A two-foot rule is a very useful measuring instrument, but you would not classify it as high-class when comparing it with micrometers and similar instruments of precision.

I should say that the term "high-grade machine," as applied to machine tools would mean: First, a machine capable of producing accurate work; second, one capable of maintaining this accuracy even after rough usage; third, rapid production.

As regards the last, the low-grade machine tool as regards accuracy might have great metal-removing possibilities. In other words, in speaking of high grade, I would subordinate all other qualities to that of being capable, by reason of its fineness of fits and the care with which it is constructed, of producing accurate work up to the highest limits of which that class of tool is capable.

E. J. KEARNEY.

THE KEMPSMITH MANUFACTURING CO., MILWAUKEE, WIS.

The following qualifications are considered by us in both the purchase of machinery for our plant as well as the machinery we manufacture and sell:

1. Well designed, (a) special or general purpose, (b) economy, (c) safety in use.
2. Well selected and proper material.
3. Well selected and proper workmanship.
4. Reasonable in price, upkeep and production.

PAUL E. THOMAS, President.

THE LEES-BRADNER CO., CLEVELAND, OHIO

While an automobile may be called "a machine," "a pleasure car" or any popular name, it does not seem to be a "machine" in the same sense as a machine tool. In other words, the automobile is simply a "conveyance" made up of a collection of different units, and, incidentally, the motive power or the engine in a gas car comes the nearest to being a machine, but if it did not have to accommodate itself to the vagaries of the rest of the completed whole it would certainly be designed differently.

The limitation to an automobile is caused by the requirements of road travel which is so uncertain that the flexibility required puts this type of machine in a different class from a machine tool. There practically all of the requirements to be met may be dealt with and the machine designed for these alone. This makes it possible for a machine tool which is high grade to perform day and night for years without repairs or disappointments.

An ocean liner is another conveyance which is similar to the automobile, only one never hears a liner called a machine. Some years ago I crossed in one of the largest and best-known liners, and while on board went below and examined the motive power. The amount of play that is necessary in the propeller-shaft main bearings to allow for the weaving of the ship without binding the shaft would eliminate it from the high-grade class of stationary engines, and yet this liner would be termed a first-class ship. I would say that a "high-grade machine" is one on which you can depend for obtaining the efficient results that it is designed to accomplish.

E. J. LEES.

Apprentices Here and in Europe

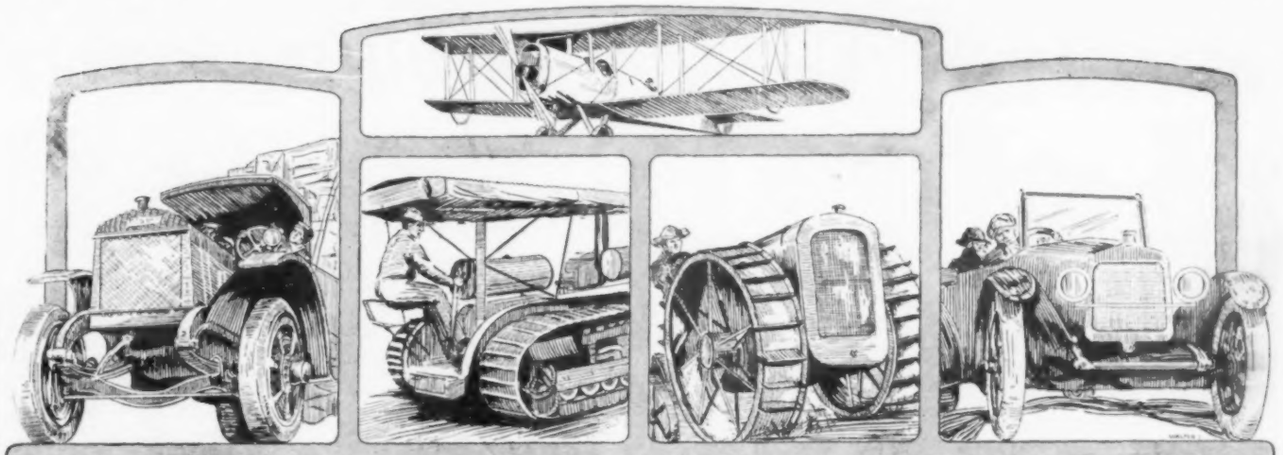
BY FRED PRICE

The article under the above heading by E. J. S. Halvorsen on page 77 of *American Machinist* is not only interesting but timely. At the present time how many men is the average shop training to become good mechanics? Very few, to say the least, in spite of the severe economic lesson taught us during the war when good men were needed but not to be had. "But," some one is sure to say, "we had courses in intensive training during the war that saved the day." True, but Uncle Sam footed the bills because the shops that trained the men worked on a cost-plus system. This was a war emergency and too costly to resort to now.

Take a few of these hastily trained mechanics and look them over, watch them handle a file, a hacksaw, a scraper or a hammer and chisel. It is really pathetic.

Today we are on the brink of the greatest industrial expansion the world has ever known. We need trained mechanics and moreover, places to train the apprentices. The proper place to teach the machinists' trade is in a machine shop, not in a trade school, as some manufacturers seems to think. Institute a reasonable apprenticeship system modeled after those in vogue in this country some 50 years ago and the result is assured. If a young man's parents realize that the boy will be taught all the ins and outs of an intricate trade they will be more than willing to see the lad start in his apprenticeship course as soon as he leaves high school. The average youth is not averse to learning a good trade provided assurance is given him that he will not be kept at routine drudgery. He knows that the luxury of the white-collared office position costs a lot of money these days.

We hear a lot about the superiority of the European mechanic. This talk is rot, pure and simple. Americans, as a class make excellent mechanics but as no one can become expert without proper training, we should start this training now, on actual work, and in our own shops. Give the boy half a chance to learn the machinist's trade, instill into his mind that the art of working metals is one of the most ancient and useful callings and we will have plenty of good mechanics a few years hence.



AUTOMOTIVE CONSTRUCTION

Machining Bearings for Liberty Motors

By FRED H. COLVIN
Principal Associate Editor, *American Machinist*

The manufacture of the connecting-rod crankshaft bearing shown herewith, is an excellent example of specialized manufacturing methods. Although a comparatively simple piece, it involves many manufacturing problems, such as changing the radius so as to allow the half bearings to be made from the same cylinder.

IN ADDITION to making the cylinder forgings for all of the Liberty motors, the Ford Motor Co. also supplied connecting-rod crankshaft bearings to a number of the other builders of Liberty motors, as well as for the motors which were built in its own shops. The making of these bearings in sufficient quantity and to the desired accuracy is a serious manufacturing problem, and the various methods employed should prove helpful in other kinds of work embodying similar problems.

The production and machine specifications are on a basis of 704 sets, or 4224 pairs per day, at a production rate of 264 pairs per hour.

The bronze cylinders were first cast in centrifugal molding machines, one of the battery of 12 being shown in Fig. 1. Each machine casts 25 pairs per hour.

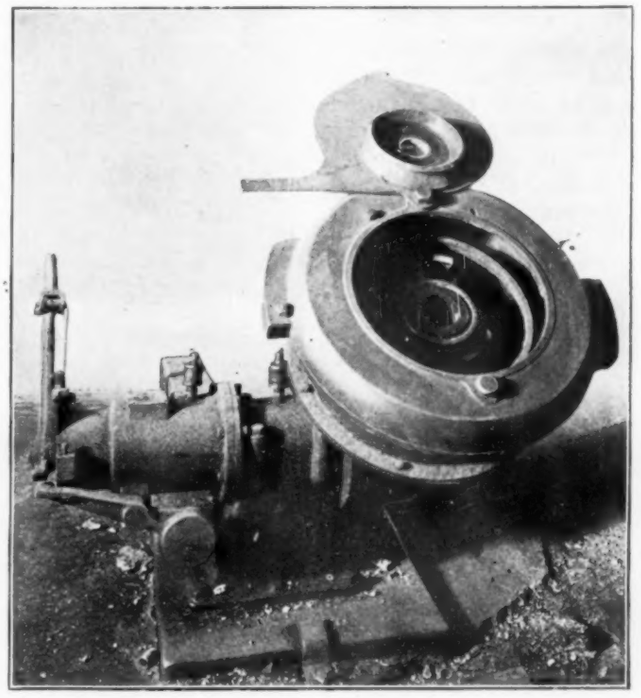


FIG. 1. CENTRIFUGAL CASTING MACHINE

If, as occasionally happens, the casting machine leaves a thin web of metal over one end of the hole, a rough-drilling operation is necessary, this being done on three Cincinnati (Ford type) 20-in. drilling machines. These have a capacity of 38 pairs per hour. The first regular operation is to rough- and finish-bore and to face one end of the bronze bushing. This is done on four Bullard Mult-Au-Matics, each having a capacity of 66 pairs per hour. This operation is shown in Fig. 2.

Next comes the turning of the outside diameter to fit the babbitting fixture and facing the other end. This is also a Mult-Au-Matic job, as shown in Fig. 3. The bushings are held on the mandrels shown; production is 66 pairs per hour.

The bushings are babbitted in the die-casting machine shown in Fig. 4, this being one of 12 special machines built for this job. Each machine handles 22 pairs of bearings per hour, is located beside a special furnace for heating the babbitt and also has suitable acid vats, the use of acid insuring the proper adherence between the babbitt and the bronze backing. In this connection it is interesting to note that the bearing metal used for this severe airplane work is practically identical with that used in the Ford motors. The action of the die-casting machines can be readily seen. The gate of the die casting is next cut off by a cross-slide tool as shown in Fig. 5. This is a Warner & Swasey turret lathe, eight of these being used. This machine has a capacity of 33 bushings per hour and also bores the babbitt lining two cutters being used in the boring bar at *A*.

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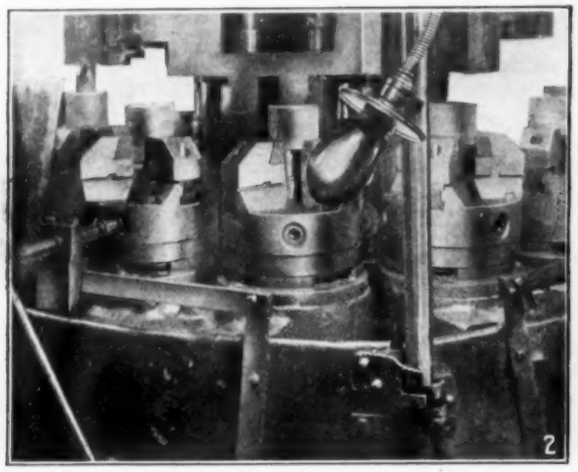


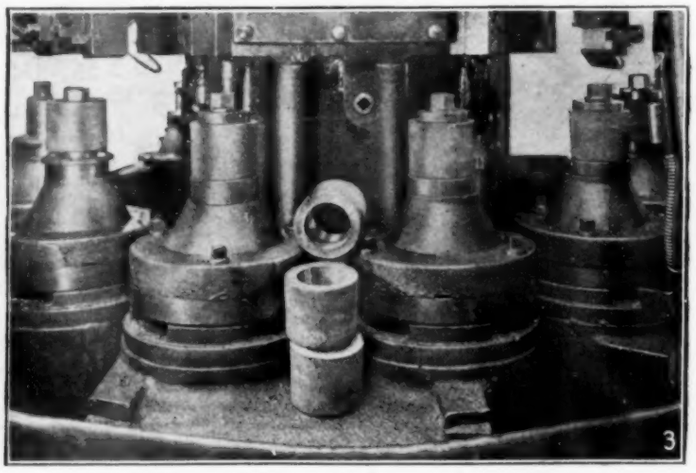


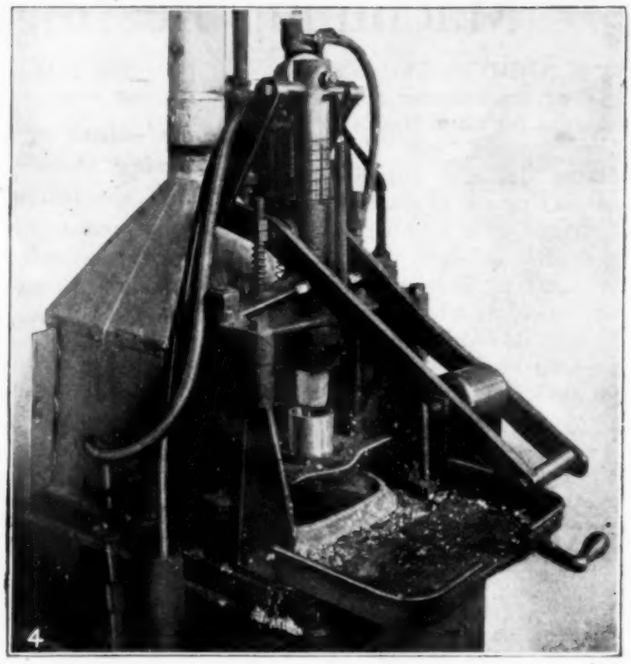
FIG. 2. BORING AND FACING BRONZE BUSHINGS
FIG. 3. TURNING OUTSIDE BUSHINGS
FIG. 4. DIE-CASTING MACHINES FOR BABBITT LINERS
FIG. 5. TRIMMING END OF BABBITT
FIG. 6. ROUGHING OUTSIDE OF BUSHING

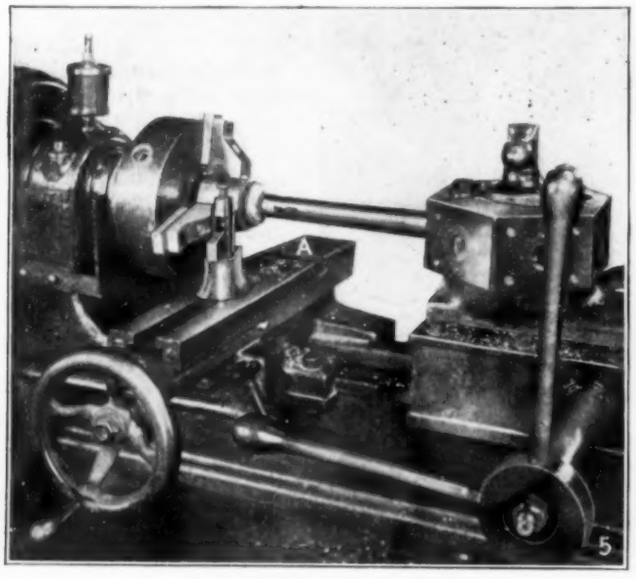
The bushings are next mounted on a short mandrel as shown in Fig. 6, which shows one of five special Reed-Prentice lathes, each of which handles 33 bushings per hour. The tools in the back rest face both ends of the bearing, while the front tool finish-turns the outside.

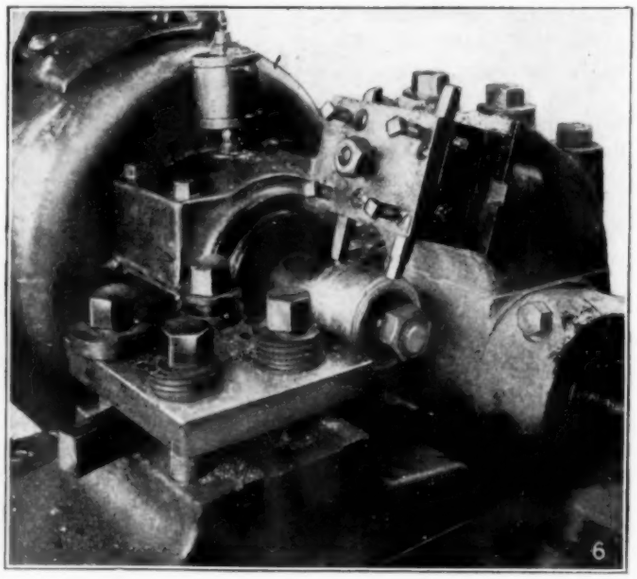
Preventing Distortion While Broaching

In order to prevent distortion of the bearings during the broaching process, they are forced into a steel holder, as shown in Fig. 7. This is one of four Greenerd arbor presses which has been fitted with the two plungers shown. The bushing at *A* is being forced into a broaching holder while the one at *B* has been forced out, after having been broached. This combines two operations, saves half the number of machines, and cuts the time in two. Each machine handles 66 pairs per hour.

The bearings are next broached in a special machine using a short-push broach, as shown in Fig. 8. This is







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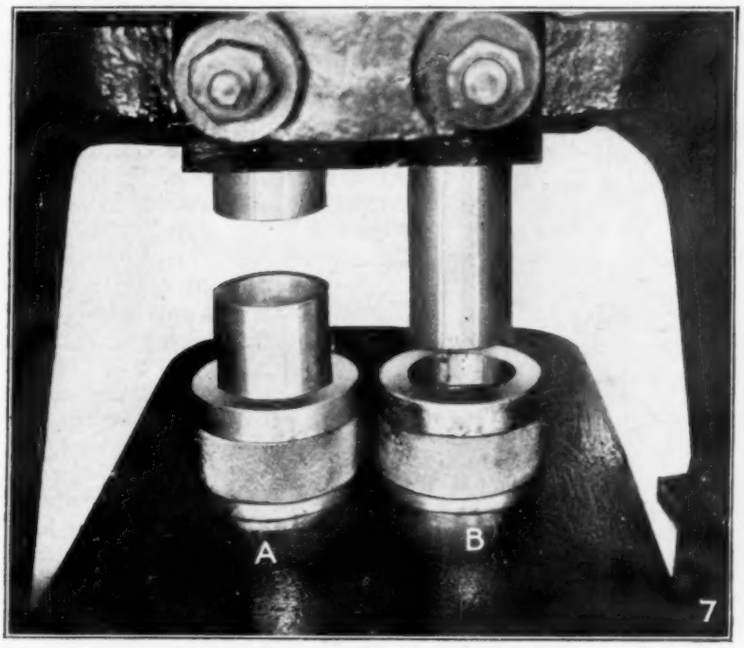


FIG. 7. PRESSING BUSHING IN AND OUT OF BROACHING HOLDER

FIG. 8. BROACHING THE BUSHING

one of six machines built especially for this work, a view of the complete machine as well as the details of its construction being shown in Figs. 9 and 10. After broaching the bushings are pushed out of the holders, as has already been shown in Fig. 7.

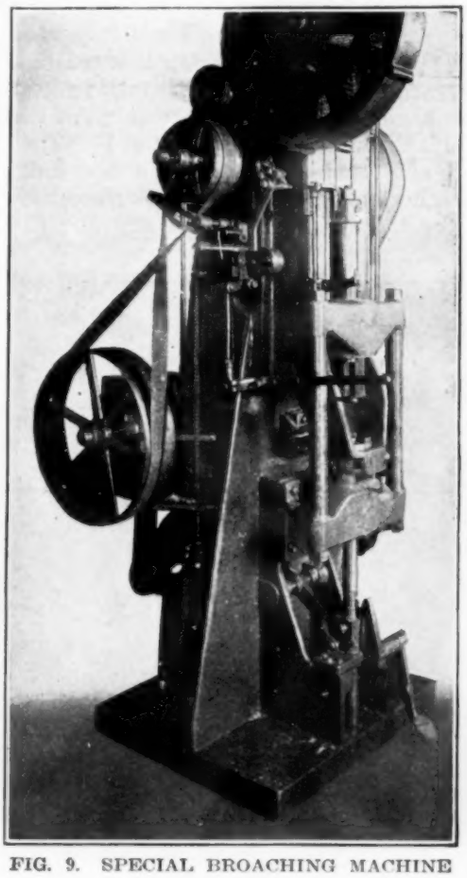


FIG. 9. SPECIAL BROACHING MACHINE

The outside of the bearings is finished by grinding, as shown in Fig. 11. Both Landis and Brown & Sharpe machines are used on this work, there being 12 in all, each handling 22 per hour and grinding the outside diameter to 3.075 inch.

In order to avoid marking or otherwise injuring the broached surface of the bearing metal, a split sleeve as shown at *A* in Fig. 11 is first slipped inside the bushing, which is then put on the driving mandrel *B* and handled in the usual manner. The split bushings and mandrel can both be seen in the grinding machine itself.

Next comes the splitting of the bushings, Fig. 12, this being done on Becker, LeBlond, and Milwaukee milling machines, a total of 15 being used for this purpose, the average production being 18 pairs per

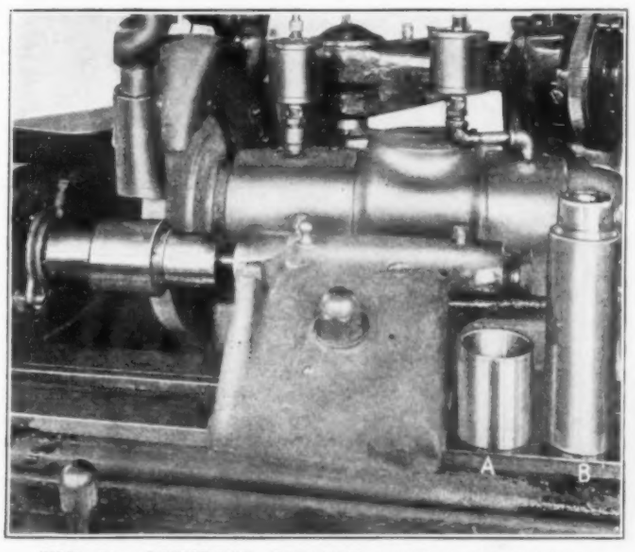


FIG. 11. GRINDING OUTSIDE FINISH DIAMETER

AUTOMOTIVE CONSTRUCTION

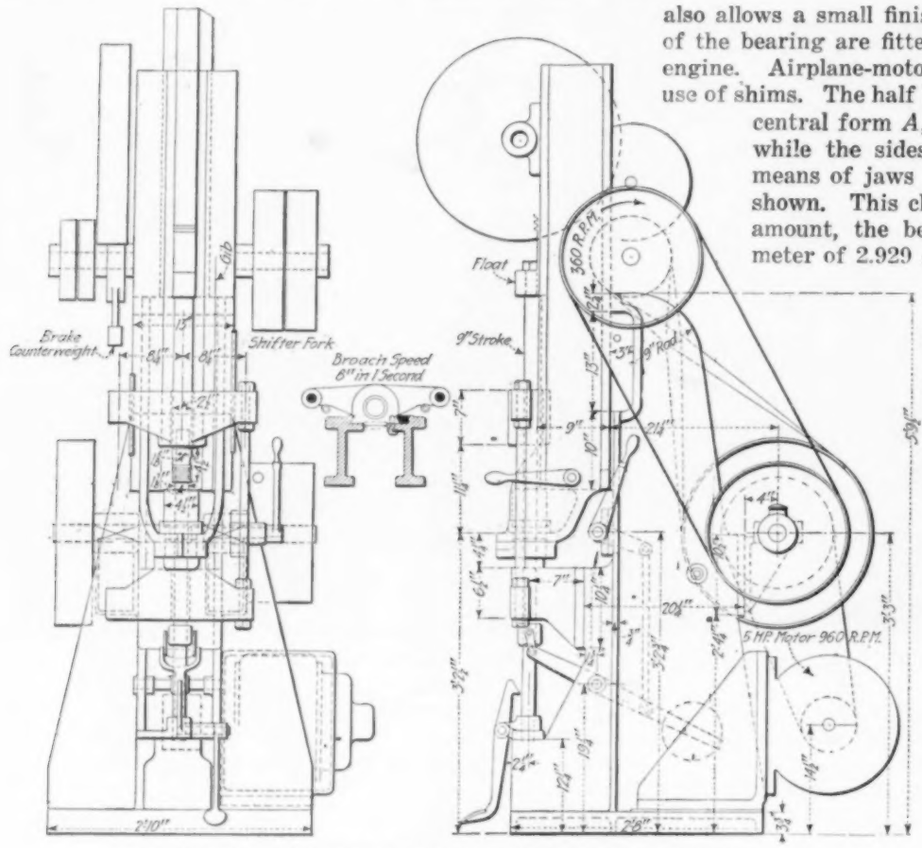


FIG. 10. DETAILS OF SPECIAL BROACHING MACHINE

hour. Two bushings are cut at the same time, as can be seen, these being placed end to end on the same mandrel. The slitting saw is $\frac{3}{64}$ in. thick.

The next two operations are perhaps the most unusual in this kind of work. The first is the closing in of the half bearings to a radius which makes up for the amount of metal removed by the slitting saws and also allows a small finishing surface, as the two halves of the bearing are fitted metal to metal in the finished engine. Airplane-motor practice does not permit the use of shims. The half bearing is held in position on the central form *A*, Fig. 13, by the upper clamp *B*, while the sides of the shell are closed in by means of jaws *C* and *D*, operated by the lever shown. This changes the radius in the desired amount, the bearing being closed into a diameter of 2.929 ± 0.005 in. When the bearings are taken out of this operation they are gaged and divided into five piles—2.529, 2.530, 2.531, 2.532 and 2.533 in. inside diameter. There are six of these special bending fixtures, each with a capacity of 44 pairs per hour.

Those who have tried bending bearings in this way have been troubled by the elasticity of the metal tending to resume its original shape and making it difficult to retain the new form. After considerable study and experiment it was found that, if after the bearings had been closed in to the desired radius they were subjected to a heavy end pressure, the effect was to permanently set the metal and so do away with all tendency to return to its original shape, thus overcoming this trouble.

Ten ferracute DG-53 presses were used for this purpose, each handling 27 pairs per hour. The method of doing this is shown very clearly in Fig. 14. The bearing is in place at *A*, and on top of it is a steel half ring *B*. Then the other half of the holder *C* is placed in position and held by the swinging bolts *D* and *E*. The stroke

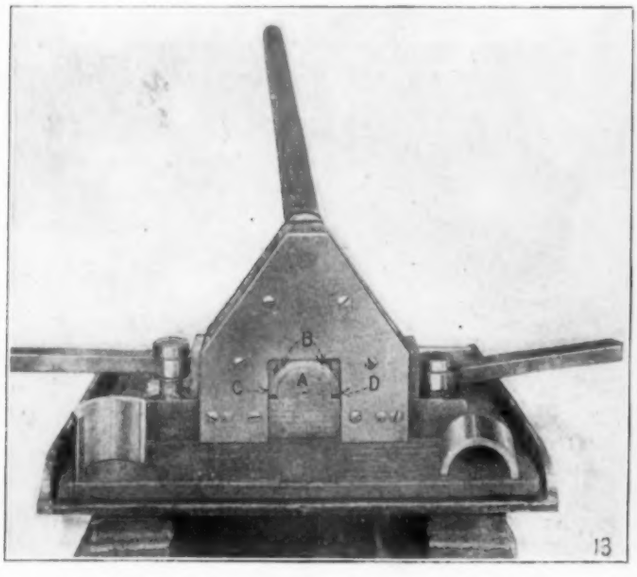


FIG. 13. CURVING BUSHINGS TO NEW RADIUS

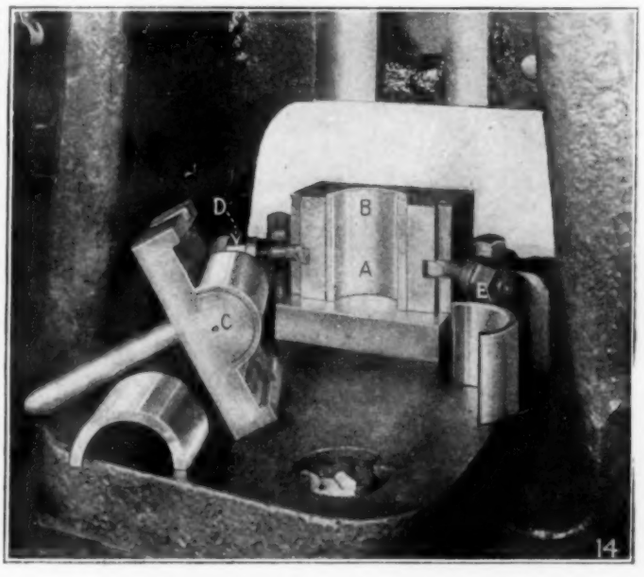


FIG. 14. SWEDGING BUSHINGS TO PREVENT SPRING

AUTOMOTIVE CONSTRUCTION

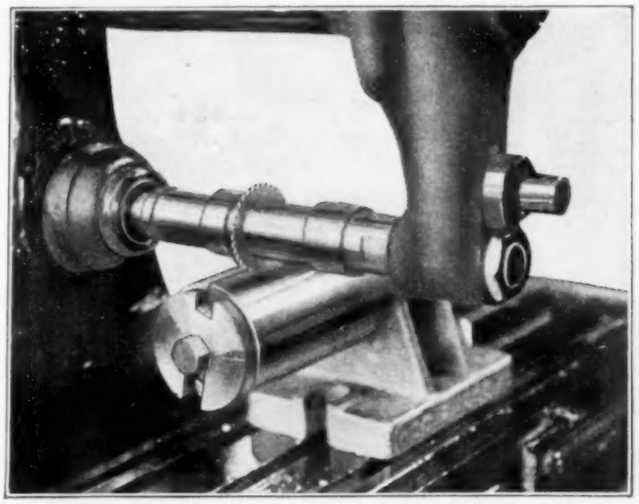


FIG. 12. SLITTING TWO BUSHINGS AT ONCE

of the ram is set to give them exactly the compression desired.

The edges of the newly formed bearings are finished in the fixture shown in Fig. 15, care being taken to clamp them firmly to their seat by means of the lock *A* and strap *B*. After this two halves are placed together and treated as one bushing in nearly all of the remaining operations.

The Facing Process

In Fig. 16 they are held on the mandrel *A* by means of the clamping ring *B*, while both ends are faced to length by the two single-point tools shown. This requires eight Reed-Prentice lathes with a capacity of 33 pairs per hour each.

Next comes the chamfering or filleting of the ends as shown in Fig. 17. The half bearings are held in the clamping fixture *A*, while the single cutter *B* trims

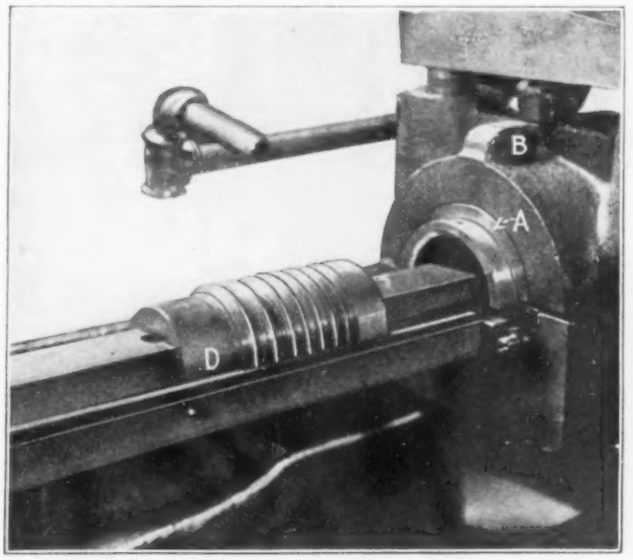


FIG. 21. REMOVING ALL BURRS

out the end of the babbitt to the desired radius. Five machines handle 53 pairs per hour, filleting both ends.

The outer ends of the bearing are next grooved to fit the spade or forked rod, as shown in Fig. 18. Twelve machines are used for this work, each being fitted with the type of cutter shown, and each handling 22 pairs per hour. The bearings are held on a mandrel in much the same way as shown in Fig. 16.

Drilling and Reaming Dowel Holes

Next comes the drilling and reaming of the dowel holes, as shown in Fig. 19. This shows very clearly the way in which the half bearing is held in the fixture, and the slip bushings which are used for both the drilling and reaming operations. This requires five two-spindle drilling machines, each having a capacity

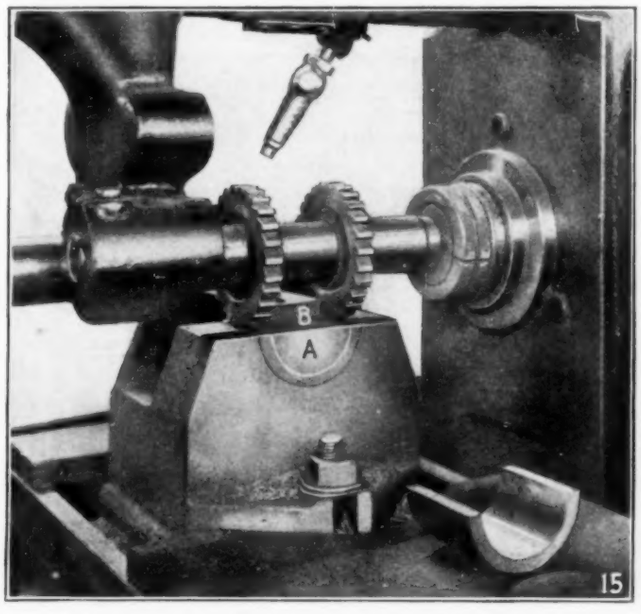


FIG. 15. FINISH-MILLING JOINTS

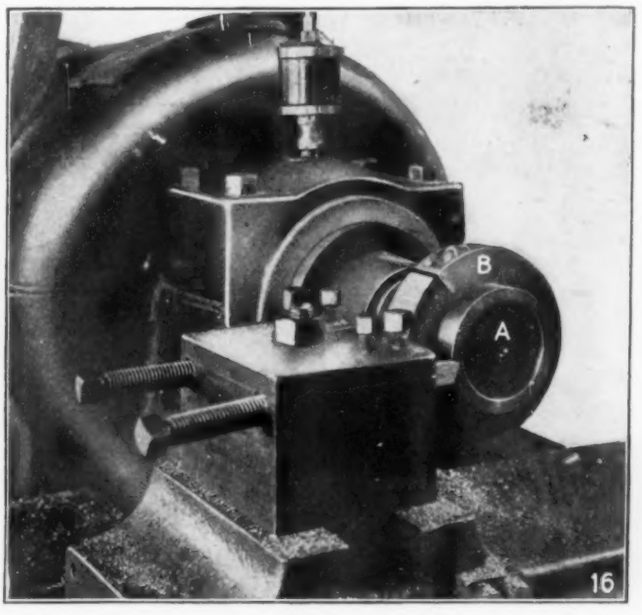


FIG. 16. FACING END TO LENGTH

AUTOMOTIVE CONSTRUCTION

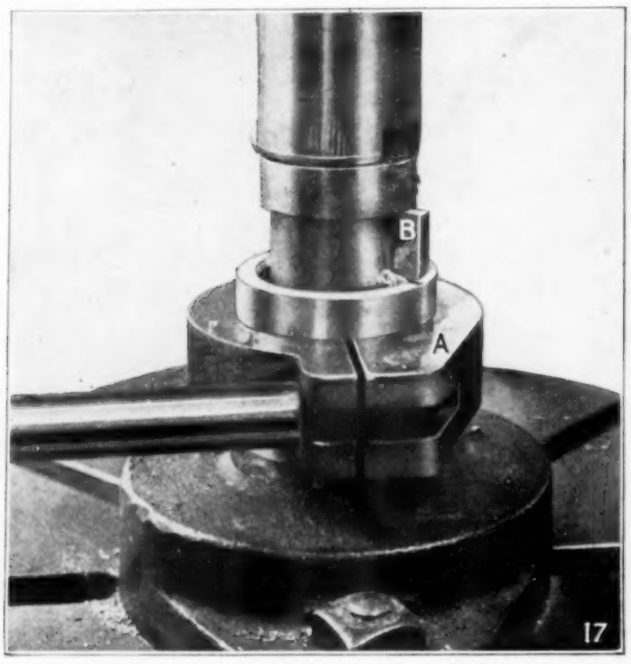


FIG. 17. CUTTING FILLET IN BEARING

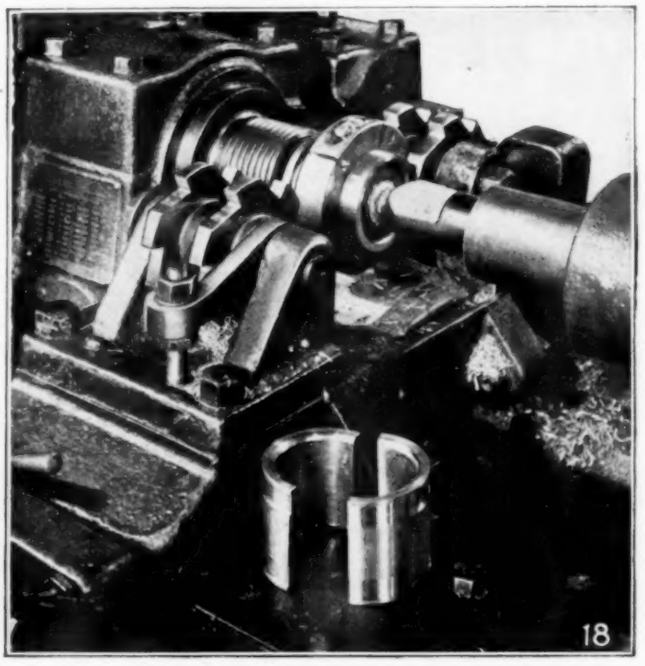


FIG. 18. GROOVING FOR FORKED ROD

of 53 pairs per hour. Two ⅛-in. oil grooves are next cut in both halves, this being a hand-milling job, which is not illustrated. Then comes the cutting of the 12 oil pockets, hand-milling operation, as shown in Fig. 20. This shows very clearly how the half bearing is held in the fixture in a vertical position and the appearance of the oil pockets after being cut. This requires six machines, handling 44 pairs each, per hour, without difficulty.

Finishing Up Bearings

The final operation is to take out the burrs which have been raised in milling the oil pockets and in drilling the dowel-pin holes. This is done in three Knowles keyseaters as shown in Fig. 21. Here the half bearing *A* is rigidly held in the special fixture *B* and clamped by a heavy screw, the lower end of which is shown at *C*. The finishing broach *D* is held in the ram or broaching bar and firmly and accurately guided as it passes under the half bearing, removing the burrs cleanly without chattering.

This finishes an extremely interesting manufacturing operation and one which produced thousands of satisfactory bearings for the Liberty motors which were built during and after the war. When the difficulties with bearings which were experienced by builders of other airplane engines are considered this achievement takes high rank among war jobs of this sort.

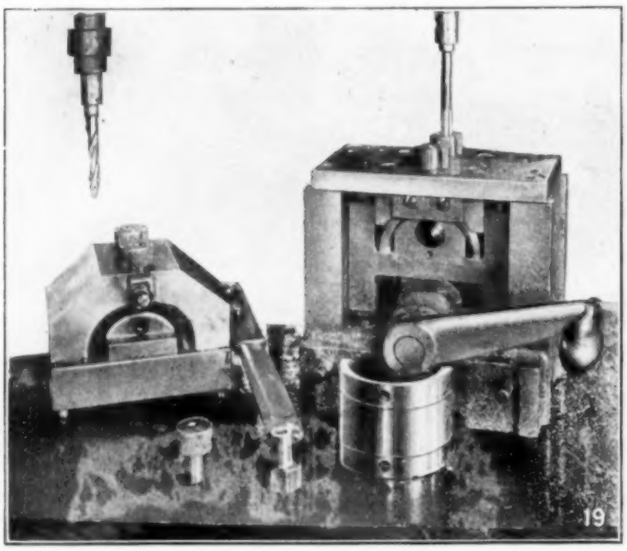


FIG. 19. DRILLING DOWEL HOLES

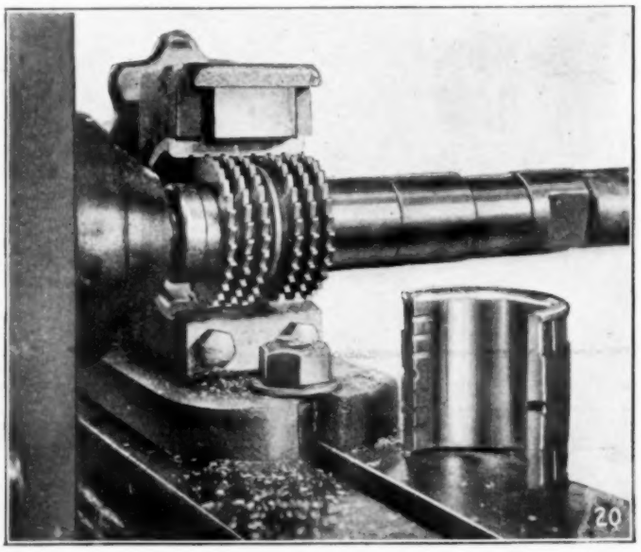


FIG. 20. CUTTING OIL POCKETS

The Use of Acetylene in the Navy Yards During the War*

BY H. G. KNOX
Commander Construction Corps, United States Navy

The tremendous amount of work, both new and repair, allotted to be done at the various United States Navy Yards during the war, could never have been completed within the time needed by methods in use a few years ago. In this paper the author tells how cutting and welding by the oxy-acetylene torch expedited work that was urgently needed for war use.

THE Navy operates a large number of Naval Stations, only a few of which are ship repair yards. The principal Navy Yards for ship repairs are at Portsmouth, N. H.; Boston, Mass.; Brooklyn, N. Y.; Philadelphia, Penn.; Norfolk, Va.; Charleston, S. C.; New Orleans, La.; Mare Island, Calif.; Bremerton, Wash.; Pearl Harbor, Hawaii; and Olongapo, P. I.

The Norfolk Navy Yard carried on its payroll during

FIG. 1. CUTTING SCRAP IN THE NORFOLK NAVY YARD

the war approximately 11,000 officers and men. The mechanics represent over 80 basic trades, with specialists, in addition to this, in many of the trades. Helpers of 20 varieties assist these mechanics, and laborers and other unskilled workers represent well over a thousand men.

Located 12 miles from Hampton Roads—perhaps the finest anchorage for ships in large numbers on the East Coast of the United States—the repair work which developed during the war can be imagined. During the war the Navy Yard probably averaged 40 ships, large and small, under repair at all times. In addition to those at the yard, ships were worked on at the coaling piers and anchorages in Hampton Roads. The number of orders for work outstanding at any time averaged about 14,000. This includes ship work, manufacturing work and plant maintenance.

To show that acetylene played an important part in Navy Yards in winning the war, the following monthly consumption of acetylene at some of the Navy Yards is given: New York, about 110,000 cu.ft. per month; Charleston, 15,000 cu.ft.; Norfolk, 60,000 cu.ft.; Boston, 75,000 cubic feet.

*Extracts from a paper read at the annual convention of the International Acetylene Association, New York, July 15, 1919.

While one is apt to think of oxy-acetylene as a means of welding, it happens that in Navy Yards probably more acetylene is used in cutting than in welding, Fig. 1. The war demanded of Navy Yards, working in many cases a 10- or 12-hr. day, the reconstruction of hundreds of ships, from the pursuits of peace to the transport of troops and the cargo carrying of war. Every time a passenger or cargo vessel is converted into a transport many changes are necessary. Bulkheads must be cut out or moved; ventilation must be installed; plumbing, berthing and messing fixtures must be manufactured and put in place. The acetylene torch, Fig. 2, cut its way through all other obstructions and provided a quick and easily transportable means of accomplishing the desired end, Fig. 3. Hundreds of cutters were employed day and night. Ships were converted, refitted and quickly sent on their way, carrying the troops which at the vital moment perhaps turned the tide of war.

Practically every plate and shape involved in ship construction, both merchant and men-of-war, requires cutting to a greater or less extent to insure fitting, for passage of pipes, for access doors and hatches, etc. By the portability of the gas cutting torch, the tool is taken to the work rather than the work brought to the tool.

In the field of armor cutting (and there are thousands

FIG. 2. CUTTING A 12-IN. BILLET AT THE NORFOLK NAVY YARD WITH AN OXY-ACETYLENE TORCH

of tons of armor in modern ships) the gas torch of course holds entire sway. Hydrogen here assists acetylene in the heavier cuts.

Many ingenious mechanical devices for guiding the torch have been developed, and, with these, a cut approaching in clearness the cut of a power-driven tool is obtainable. On account of the cleanness of cut, Fig. 4, the gas torch is, of course, always preferred to the carbon arc.

EMERGENCY REPAIRS

Not only were ships built during the war, but the Navy Yards were many times called upon for emergency repairs; often so extensive as to involve the rebuilding of an entire section of a ship. At New York the work on the "Texas," "Huntington," "Olympia" and "Aeolus" would have been many weeks delayed without the gas

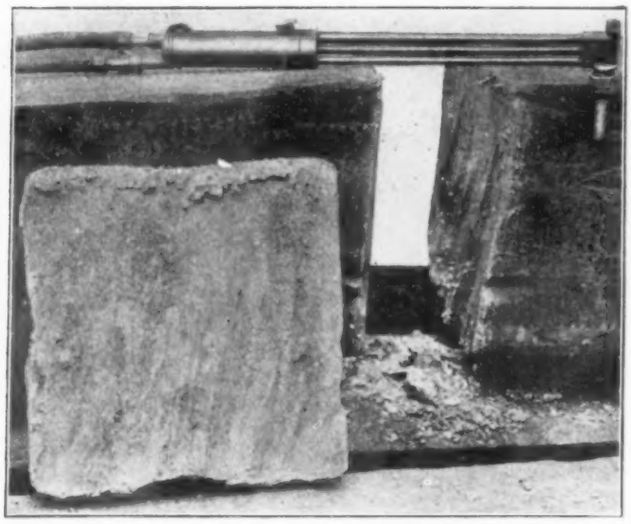


FIG. 3. A SECTION CUT FROM A 12-IN. STEEL BILLET, SHOWN IN FIG. 2

torch. Boston did similar excellent work on the "Mount Vernon," "America," and "Covington," also in converting the "Shawmut" and "Aroostook" into mine layers. At Philadelphia the replacement of the whole forward end of a battleship which received the full impact of a mine explosion could never have been done in the required time in which it was accomplished without acetylene. Boston had a like job on the torpedoed "Mount Vernon."

When we come to the field of gas welding, Navy Yards do not differ, except in the variety of their work, from many of the other shops with which you are all familiar. Remember only that every metal-working trade at one time or another falls back on welding.

Welding by the Electric Arc

The electric arc has an important part in the welding of structural steel and steel castings and forgings, but, nevertheless, acetylene is also extensively employed in this class of work. We feel, too, that the gas weld responds to annealing or other heat-treating much better than does the arc weld.

While the welding by electric arc of the non-ferrous alloys is undoubtedly possible and may some day be extensively used, the use of the oxy-acetylene torch for this work up to the present has been practically universal. The welding of angle bars, Fig. 5, and in fact all of the shapes used in ship construction, heretofore done by the blacksmith, is rapidly being taken over by the gas or arc welder; and fittings built up out of scraps of plates, shapes, pipes, etc., are everywhere in evidence. The cost of the gas-welded article is very much less than when made by the smith. The entire drainage system, including most of the fittings of the three destroyers now being completed at Norfolk, was made by welding scraps of steel together, thereby eliminating castings. The welding of pipe, Fig. 6, and pipe fittings offers a wide field for ingenuity. Flanged elbows may be made by filling steel tubing with sand and making four close right-angle bends. When cut apart, scrap steel flanges are welded on to complete the elbows. Tees, crosses, deck and bulkhead fittings are likewise readily made up.

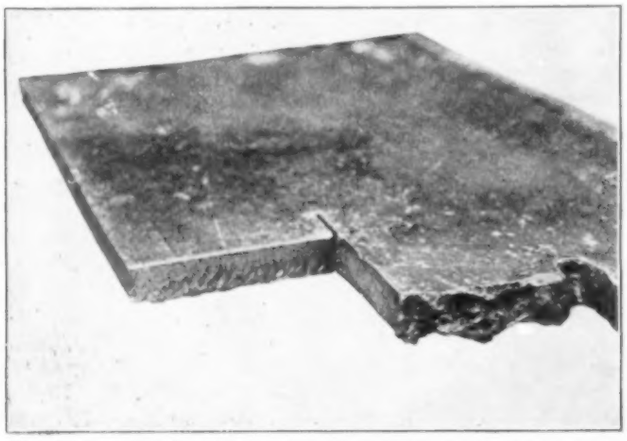


FIG. 4. SHOWING THE SUPERIORITY OF OXY-ACETYLENE CUTTING OVER CUTTING BY CARBON ARC

Welding Non-Ferrous Metals

One of the most frequent calls for repairs is on propellers, Fig. 7. New tips, new edges, and in some cases practically entire blades, are recast from manganese bronze and welded on successfully. Fittings for submarines also come in for their share of welding, and these must not only be strong but tight. Portsmouth, N. H., specializes in submarine construction, and frequently has to weld large manganese bronze castings for these undersea craft.

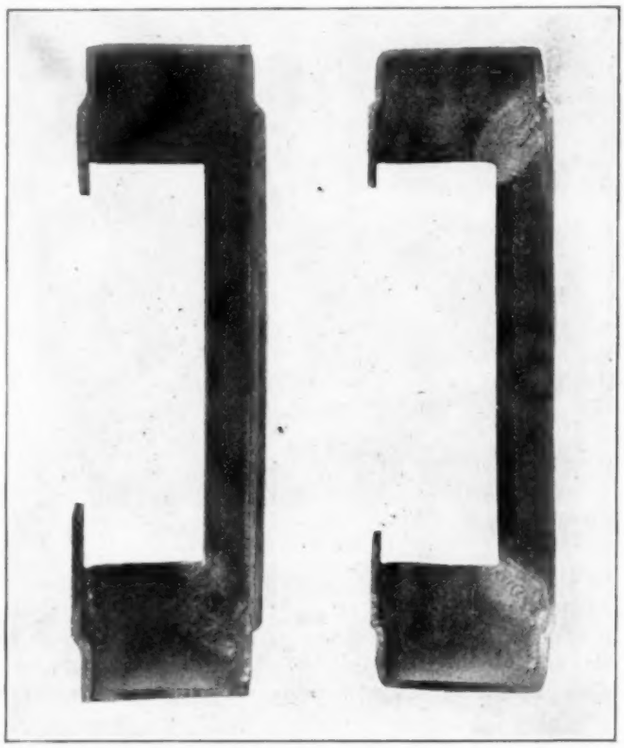


FIG. 5. BULKHEAD STAPLES MADE BY OXY-ACETYLENE WELDING AND CUTTING

In addition to manganese bronze and bell metal, we also encounter in large quantities gun metal, valve bronze, journal bronze, naval brass, muntz metal, phosphor bronze, and last, but not least, pure copper. Under intelligent operation the gas welding of copper may some day almost completely supplant the coppersmith's art of brazing. Naval-rolled brass is the favorite filling material for copper and most of the other brasses and bronzes. Samples of copper pipe made up

out of $\frac{5}{16}$-in. sheet copper have been hydrostatically tested to destruction and the welded seams compared very favorably with brazed seams. Cast iron is also

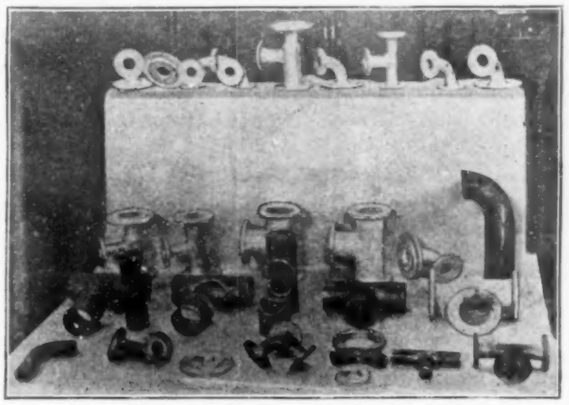


FIG. 6. STEEL FITTINGS MADE OUT OF SCRAP TUBING BY OXY-ACETYLENE WELDING

welded more reliably with oxy-acetylene than with the electric arc.

There are times when, due to the complexity of a casting, the arc rather than gas may be more conveniently used. The use of carbon blocks and carbon paste, of course, greatly extends the field of the gas torch in difficult jobs, and these aids are freely used.

The preheating of a complicated iron casting is often not permissible, and a "cold" weld is more common with the arc than with gas. Gas, however, more than holds its own in the special field of cast iron.

Much has been said about the salvaging of the main engine cylinders of the German ships at various Navy Yards, particularly the New York Navy Yard. The repairs to engines effected by welding on these ships undoubtedly is one of the most spectacular feats of the war. At New York all of the welds were made with the electric arc, as were a few at Philadelphia, Boston and Norfolk. So far as I am aware all of the welds made on these cylinders have stood up perfectly in service.

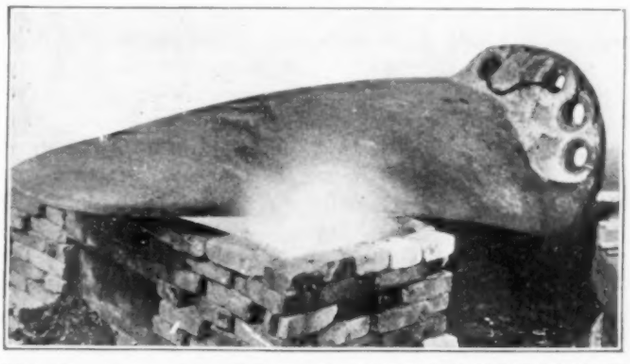


FIG. 7. NEW TIP REPLACED ON MANGANESE-BRONZE PROPELLER BLADE BY MEANS OF OXY-ACETYLENE PROCESS

At Norfolk three German ships were delivered for repair—the "Rhein," "Neckar" and "Bulgaria." The major portion of the welds on the damaged cylinders of these ships were made by oxy-acetylene. The only bad break on the "Bulgaria" was repaired by electric arc. On the "Rhein" and "Neckar," however, all of the major welds were made with gas. Six of the "Rhein's" eight cylinders were gas welded. Six of the "Neckar's" eight cylinders were also gas welded.

One important point in comparing gas and arc welds in cast iron that was brought out by the big cylinder job is the superior machining of the gas weld. A welded cylinder liner, for example, machined with no trace of hardness at the cleavage line between parent metal and filler. This was seldom the case with the arc welds where machining was required.

While ship work represents the principal activity of the Navy Yard, yet most of the Navy Yards carry on considerable strictly manufacturing work. A few of the yards have developed specialties in many fields.

At Norfolk, for example, no less than 26,500 rectangular pipe bunks for transports were welded during the war. Gasoline tanks, numbering 9000, for motor boats were also turned out during the same period. The longitudinal seams of these tanks were mechanically welded on a "barrel welder." Norfolk also manufactured over 200,000 metal packing boxes for the Bureau of Ordnance. These air-tight boxes are used for the transportation of smokeless powder from the factories where the charges are made up. The nozzles were welded to the tops of these boxes by oxy-acetylene.

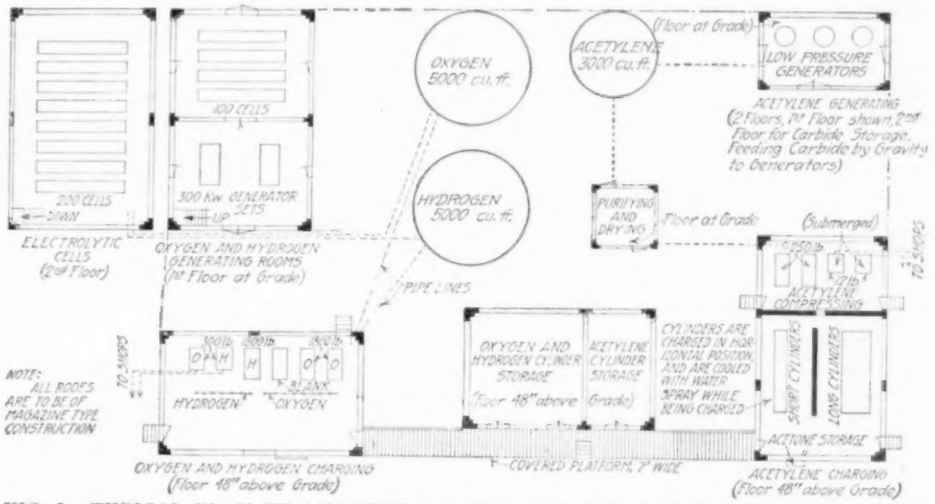

OXYGEN 5000 cu. ft.
ACETYLENE 3000 cu. ft.
(Floor at Grade)
LOW PRESSURE GENERATORS
ACETYLENE GENERATING (2 Floors, 1st Floor shown, 2nd Floor for Carbide Storage, Feeding Carbide by Gravity to Generators)
100 CELLS
200 CELLS
300 Kw. GENERATOR SETS
DOWN
UP
HYDROGEN 5000 cu. ft.
PURIFYING AND DRYING
Floor at Grade
(Submerged)
ELECTROLYTIC CELLS (2nd Floor)
OXYGEN AND HYDROGEN GENERATING ROOMS (1st Floor at Grade)
PIPE LINES
ACETYLENE COMPRESSING
10 STEPS
300lb
HYDROGEN
BLANK
OXYGEN
OXYGEN AND HYDROGEN CYLINDER STORAGE (Floor 48" above Grade)
ACETYLENE CYLINDER STORAGE (Grade)
CYLINDERS ARE CHARGED IN HORIZONTAL POSITION AND ARE COOLED WITH WATER SPRAY WHILE BEING CHARGED
SHORT CYLINDERS
LONG CYLINDERS
ACETONE STORAGE
NOTE: ALL ROOFS ARE TO BE OF MAGAZINE TYPE CONSTRUCTION
OXYGEN AND HYDROGEN CHARGING (Floor 48" above Grade)
COVERED PLATFORM, 7' WIDE
ACETYLENE CHARGING (Floor 48" above Grade)

FIG. 8. TYPICAL PLAN OF AN OXYGEN, HYDROGEN AND ACETYLENE GENERATING PLANT, FOR NAVY YARDS

The biggest single war-time job of a manufacturing nature undertaken at Norfolk was the manufacture of nearly 15,000 naval defense mines. Each of these mine spheres involves a 10-ft. gas weld at the equator seam; 10 to 20 men were employed continuously on this work.

A use for acetylene in Navy Yards, which is out of the ordinary, is its availability for the local heating of structural plates and other members, particularly when damaged by collision. It is often necessary to straighten plates or remove bumps, and the quick local heating of such work is done, although perhaps not economically, by acetylene. During the war many vessels were fitted with underwater mine-sweeping devices, and the shaping and bending of plates by acetylene for this work was quite common.

One more use for acetylene may be mentioned, although it is not general; this is lighting. Some of the Navy Yards during the war on more than one occasion fell back upon portable acetylene-lighting equipments for their emergency work in the bottoms of dry docks or other places where electric flood lamps could not readily be installed.

While not part of the Navy Yard's activities, several of the Navy Yards actually supply the Lighthouse Department with most of the gas used in the thousands of gas-lighted buoys which mark the water highways of our coasts. These gas buoys have reached a remarkable state of reliability, and acetylene is practically the only illuminant now used.

Most of the Navy Yards are equipped with their own gas-generating plants. Few of the yards are, however, self-supporting, and they are therefore dependent on outside concerns for making up the deficiency.

Proposed Layout for Navy Generating Plant

Immediately after an unfortunate accident in the gas-generating plant at Norfolk in May of this year, I had the privilege of visiting two or three of the largest gas plants in the country; and, as a result, have prepared a type plan of gas-generating plant for Navy Yard use, Fig. 8.

In this layout an attempt was made to separate the various gases, and in case of acetylene the various stages of production, from generation to storage of gas in tanks. This plan also contemplates the piping of acetylene at about 12-lb. pressure to all the shops in the vicinity of the centrally located gas plant. In this way the high-pressure compression of much gas can be avoided as well as the transportation of gas tanks. This method has already proved very efficient in many yards. Oxygen and hydrogen are likewise piped to manifolds at convenient points on the shop walls.

Concentrating the Work in One Shop

An innovation recently started at the Norfolk Navy Yard is the establishment of a welding shop. This does not mean that the welding shop will control or perform all welding work, but it will be the headquarters for welding and cutting equipment and trained operators. This shop will, however, do all the job welding on castings and other work removed from ships for repair. The welding shop furnishes trained men to other ships on permanent or temporary details, often in large numbers. By concentrating the work in one shop under a single foreman, we are able to much better control the technique and at the same time accomplish the maximum of work with the minimum force.

The equipment of this shop includes a complete gas cutting and welding outfit, as well as fixed and portable arc-welding equipment. This shop furnishes all the electrodes and filling material, protecting devices, and in fact all of the adjuncts necessary to welding.

Scarcity of Welders

In the increase of the welding activities it became impossible during the war to obtain trained welders. We therefore undertook the training of our own men, and the school now established, which works in connection with the welding shop at the Norfolk Yard, not only supplies our trained operators, but it is also the central training point for operators from the other East Coast Navy Yards. By giving students not only practical work, but lectures in the properties of metals, the expansions and contractions encountered in welding, and in kindred subjects, we endeavor to turn out students who, after they have spent a few months in practical work outside, can at any time be called upon to face the variety of problems which are, with us, an every-day occurrence.

It would be impossible to detail the activities of our indispensable ally—acetylene, nor in the scope of one short paper could one even begin to give an idea of the part it played directly and indirectly in winning the war with Germany.

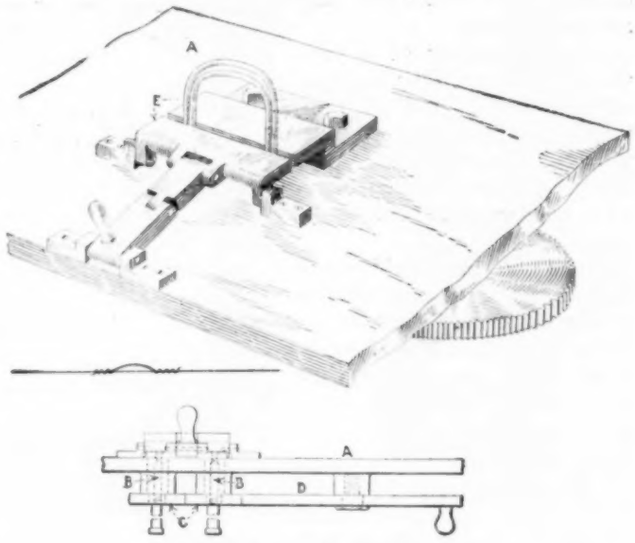
Twisting a Loop in a Baling Wire

By R. P. Deane

I once built a hand-operated machine for twisting two pieces of soft-iron wire together as shown in the sketch. I believe they were used for baling wires, although for what purpose the loop was made I never knew.

A baseplase *A* carries two vertical shafts *BB*, on the lower ends of which were the small gears *C* meshing together, and also meshing with a large gear *D* (ratio 4 to 1), which turned on a stud.

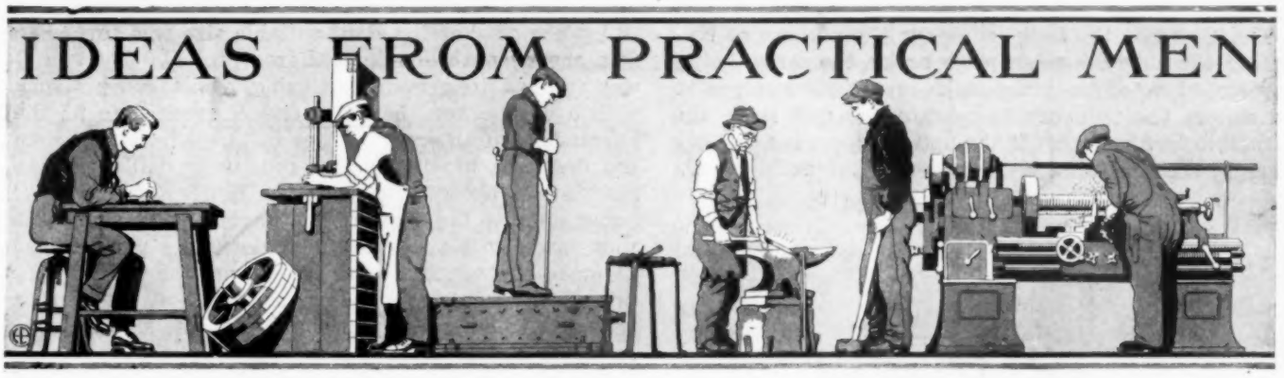
The lower ends of the shafts were drilled and tapped



DEVICE FOR TWISTING WIRE

for ¼-in. pipe and the tap drill was run to within an inch or so of the top of the shafts. Two small holes, a loose fit for the wire, were drilled from the top of each shaft about $\frac{1}{16}$ in. each side of the center, one hole in each going through to the pipe; the others being blind holes about ¾ in. deep. Pipes were screwed into the holes in the lower end and caps put on them. The pipes were of such length as to form stops for gaging the length of the long wire. The bottoms of the blind holes gaged the short wire. *E* is a clamp operated by a toggle and hand lever.

In operation the wire is straightened and cut to length; then both ends of the long wire were put through the small holes in the upper ends of the shafts with their ends touching the bottom of the pipes and both ends of the short wire put into the blind holes. The clamp is then closed and the large gear given one revolution.



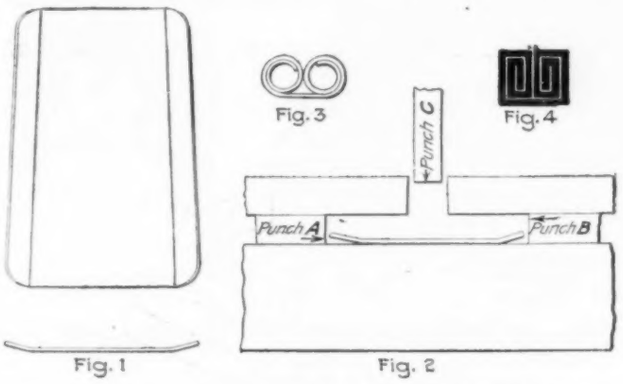
Nails Made From Tin Scrap

BY MATTHEW HARRIS

Some forty years ago the bulk of illuminating oil destined for retail trade was shipped from the refineries in 5-gal. cases, two cans to a case. Cans and cases were charged for with provision for a rebate upon their return.

Many cans were returned in bad order—too bad to be used again—so that the refineries accumulated lots of this bulky scrap.

Later, some of the larger refineries began to make their own cans, and the scrap tin from the can departments added to the old cans soon became a nuisance. Various methods were devised to reduce the bulk of



FIGS. 1 TO 4. HOW THE NAILS WERE MADE

Fig. 1—The blank punched from scrap. Fig. 2—Arrangement of punches and blank. Fig. 3—Curling the blank. Fig. 4—Section of the nail body.

the scrap pile, and at the same time to salvage anything of value contained therein. Special arrangements were made for melting and recovering the solder from the can seams and the cans could then be opened out and baled. In this condition they had some market value, but as this value covered only the iron content, someone suggested that an additional revenue might be secured if the tin coating could be melted off and recovered. After some experimenting arrangements were perfected for detinning the sheets. In the meantime the scrap from the can-making department was accumulating and as this scrap had little or no market value and would not pay for the expense of detinning it, it was suggested that some way be found to utilize it as well as the detinned scrap from the old cans.

Some genius in one of the large refineries conceived the idea of making nails out of this scrap and invented a machine to make them. This machine was built under the writer's supervision about thirty years ago, and as near as he can remember the nails were of 4d size and the process of manufacture was as follows:

Fig. 1 represents the blank as punched from the scrap and, as will be seen from the end view, the sides were slightly bent. These blanks were stacked in a magazine on the nail machine from where they were automatically fed to the punches. The machine had three punches and a header. The arrangement of the three punches and the position of the blank are illustrated by Fig. 2. All the punches operated simultaneously. Punches *A* and *B* curled the bent edges over and rolled them, about as shown in Fig. 3, while punch *C* came down on the top with the result that the rolled blank was mashed into a square, the parts resembling right- and left-hand "walls of Troy," as shown in Fig. 4.

With the nail body tightly gripped in the punches, a header at the front advanced and upset the head.

This machine made about 40 nails per minute. They were stiffer than either wire or cut nails, and repeated trials showed they could be successfully driven into hard wood and knots where ordinary nails would bend and buckle.

The nails were used in automatic machines for nailing the cases in which the cans of oil were shipped. Whether they are still used or not the writer does not know, but his recollection is that the difference in cost over the market price of nails less that of the scrap was too great.

Forming an Accurate Ball on the End of a Rod

BY HERBERT FOX

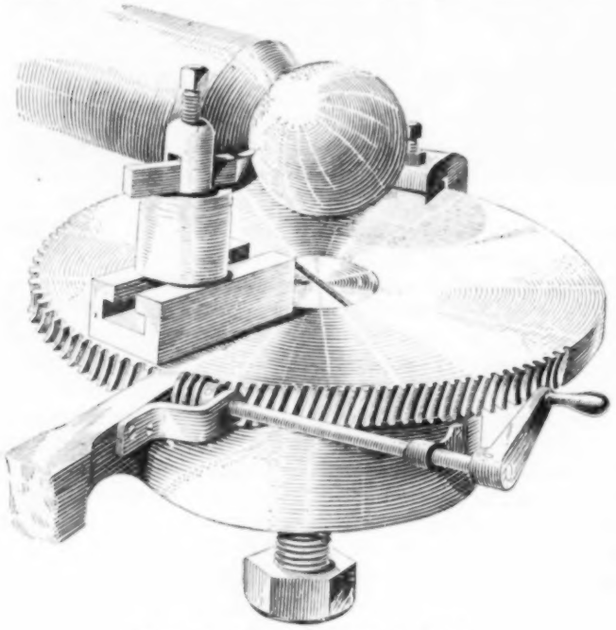
Because of having seen in the columns of the *American Machinist* descriptions of various methods of turning a ball on the end of a rod, I am sending you the accompanying sketch of a device we have in our shop for the same purpose.

The whole affair is mounted upon a shank that can be held in the toolpost of the average lathe and its construction is so evident from the picture that but little need be said.

The turntable turns freely without shake on the central stud, and the wormwheel teeth in its periphery may be cut all the way round if more convenient to cut them that way as it usually is, but, of course, only half of the periphery is used.

The large nut on the underside of the holder is for the purpose of screwing down against the top surface of the cross-slide, to act as a support to receive the thrust of the cut.

The clamp on the backside is for the purpose of balancing the cut; the loose piece under the screw being a piece of wood or brass held just tight enough to counteract the tendency to vibrate and still leave the turntable free to turn. If the undersupport is made big enough, the central stud made large, and sufficient attention given to the fitting, the clamp may be dispensed with. There is no provision made on our device for adjustment, except by tapping with a wrench or hammer but if one desired it would be a comparatively simple matter to add a screw-operated slide.

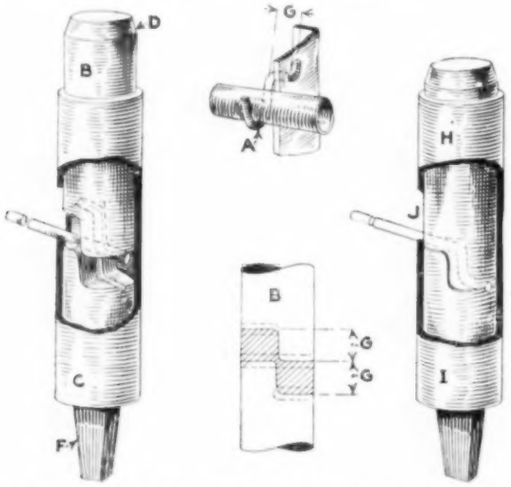


DEVICE FOR TURNING A BALL

Forming a Pipe Hanger

By H. O. Shields

I was recently confronted with the job of making a large number of pipe hangers *A*, as shown in the accompanying drawing. Because of the quantity required, I looked around for a substitute for the usual hand-blacksmithing method. The following punch and die was made with the tools found in a jobbing blacksmith shop and proved to be very efficient.



A FORMING FIXTURE FOR A PIPE HANGER

A piece of shafting *B* of suitable size was turned to fit a short length of standard iron pipe *C*. One end *D* was tapered to prevent battering, while being struck with a sledge, and the other end *E* squared to fit the hardie hole of an anvil. Three holes, $\frac{1}{16}$ in. larger than the diameter of the hanger rod, were drilled in the shafting as shown, the center to center dimensions *G* being equal to the offset of the hanger. The shaft was then sawed into two pieces and the upper part formed to make the punch *H* and the lower, the die *I*. The pipe *C* which acts as a liner is slotted as at *J* to permit the work to enter the punch and die; the side opposite acting as a stop.

The stock is brought to a red heat, placed in the tool and formed by striking the punch with a heavy sledge. The view also shows the device assembled with the hanger between the punch and die. The hook in which the pipe lies is formed in the ordinary way, using a piece of shafting the size of the pipe for a mandrel.

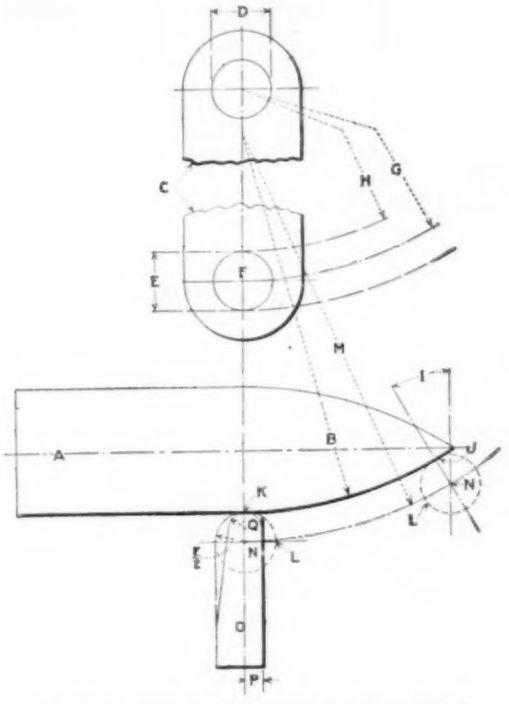
Radius Link Designing

By Francis W. Shaw
Manchester, England

Not a few mistakes occurred in the early days of the war in designing the link- or radius-bar attachment intended to guide the turning tool in the course of a circular arc corresponding to the contour of shell noses.

The article on page 993, Vol. 50, is, in effect, a statement of the case and one solution thereof, though a restriction imposing one.

The writer of the article claims that the radius of the moving pin *E*, shown in the illustration, is a governing factor in the design. That this is a fallacy can readily be proved. Neither is it necessary to make the plan contour of the cutting edge of the tool of a radius that bears any particular ratio to the radius of the pin *E*.



RADIUS-LINK SHELL-TURNING LAYOUT

When a series of slides capable of moving only in rectangular coördinate paths, as is the case of a saddle moving along a lathe bed and a cross-slide moving transversely on the saddle, are radius-bar controlled, every point in the parts which partake of the combined movements moves in a similar path. In the case of a lathe tool-rest adapted for nose-turning, the cross-slide has a longitudinal movement controlled by the feed and a transverse movement controlled by the radius bar. Since the axis *F* of the link is also a point on the cross-slide, and as the point *F* moves in a circular path of a definite radius, so must every point on the cross-slide move in a circular path of this same radius; and this radius is precisely equal to the center-to-center length of the link, the diameter of the pin *E* having no influence whatever upon it.

It is the form of the cutting edge of the tool, with a given radius of nose contour, which determines the length of the radius bar. Obviously, the path of the center *N* of the tool nose must be a circular arc greater in radius by the radius $\frac{1}{2}$ *E* than the radius of the work contour. Every point of the slide which supports the tool must, then, move in a circular path of radius $B + \frac{1}{2}E$ and the center-to-center length of the radius bar must therefore be equal to $B + \frac{1}{2}E$, where *E* is the diameter of the tool nose and not of the pin *E*.

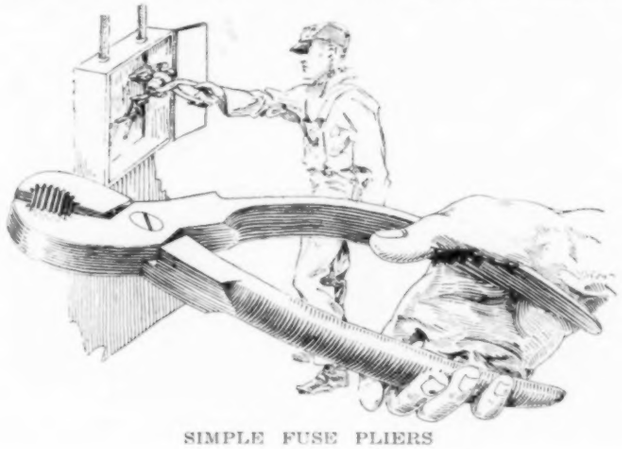
Thus, the radius of the tool nose may be made as small as is desirable for efficient cutting, provided the link length be altered to suit. It may even be a sharp point, in which case the link length will be just equal to the radius of the nose contour; for then *M* becomes equal to *B*.

In cases where, in order to get efficiency in the roughing cut, combined with good finish in the finishing cut, it is desirable to have a small-radius tool for the roughing and a large-radius tool for the finishing, and where the same lathe takes both cuts, it is expedient to employ an adjustable radius bar, the two distances being fixed by two pairs of holes and a pin removable from one pair to the other. It is also a simple matter to employ two radius bars of different lengths interchangeable on upward-projecting pins without nuts, the bars being held in position by gravity.

Simple Fuse Pliers

By I. E. Pearce

It is a common thing to see electricians, shopmen, and in fact many others who should know better, pull and replace blown fuses from fuse blocks with their bare hands. This practice is contrary to fundamental safety-first principles and should not be tolerated. Handling fuses with the ordinary side-cutting pliers with insulated handles removes the hazard, provided the insulation on the handles is good. But how many pliers are properly insulated?



SIMPLE FUSE PLIERS

A safe and dependable pair of pliers can be made, without much outlay in expense or labor, from common phenol (red) fiber or hard maple similar to the design shown in the sketch. The writer has such a pair made from hard maple that has seen many years of hard service and has, no doubt, saved him many a kick. Incidentally, the pliers were made after juggling a generous amount of "four-forty" through the insulated handles of a pair of side-cutting pliers.

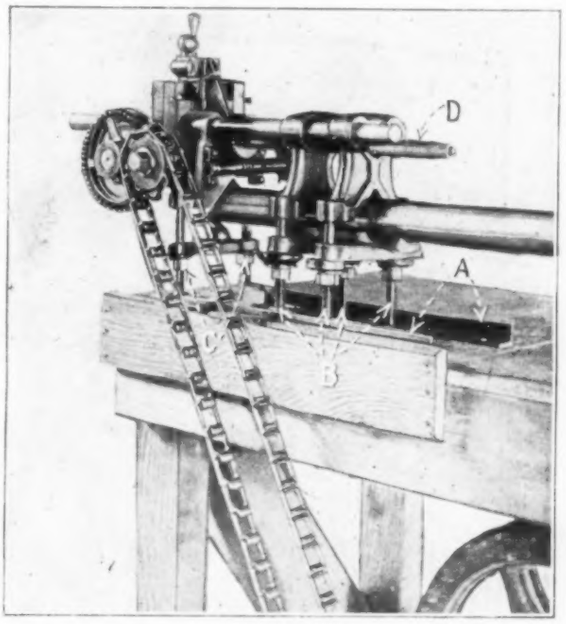
Increasing the Output of a Portable Keyseating Machine

By W. B. Conant

We had a quantity of keyseats to cut in some large shafts and the only machine in which to do the job was a Burr portable keyseating machine designed to be operated by hand. To do the work by hand on this machine was too slow and expensive, so it was determined to apply power to it.

A small motor was mounted on wall brackets and belted to a countershaft placed beneath the work bench and from this a chain drive was arranged to the cutter arbor as may be seen in the illustration.

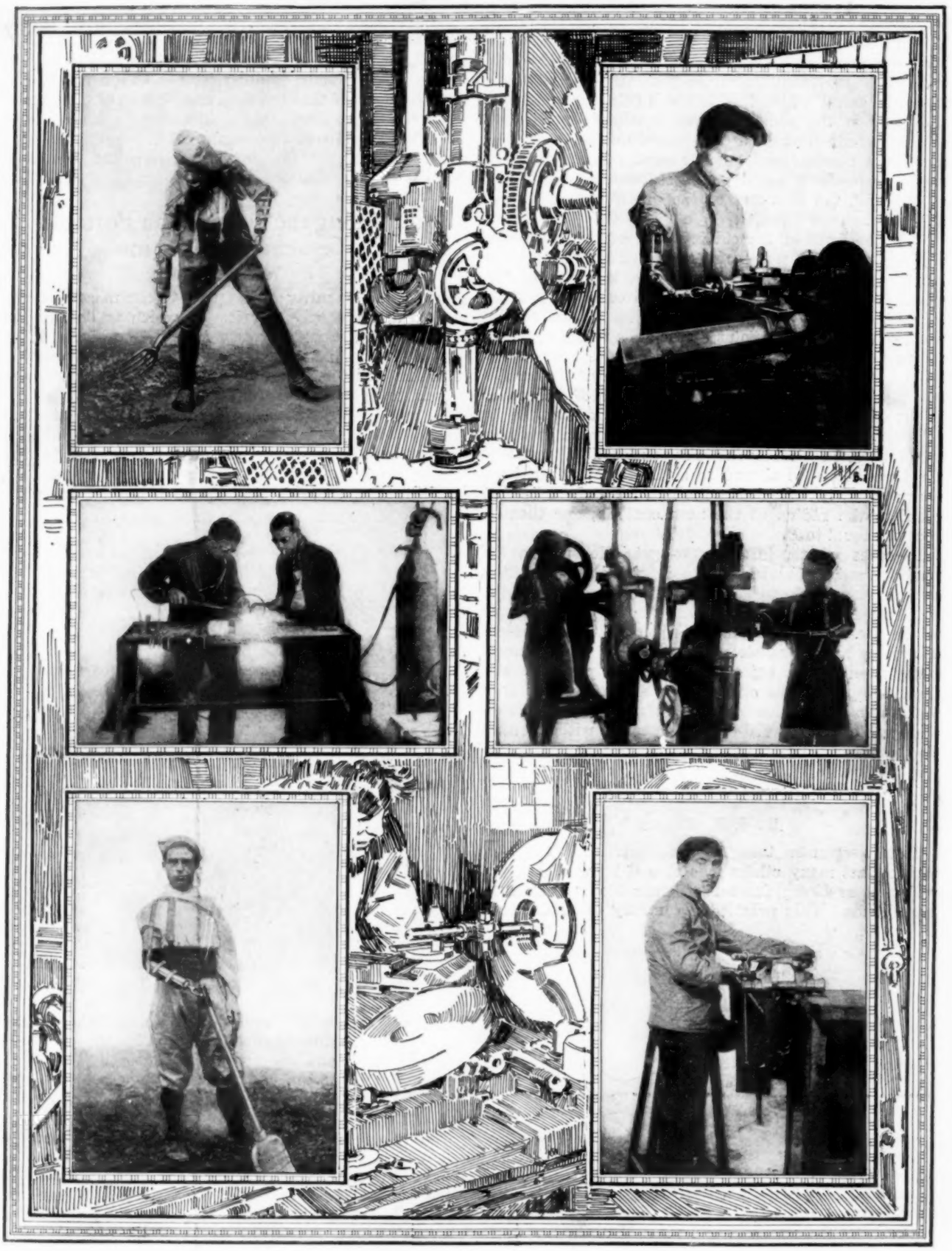
The problem was to keep the chain tight in all positions of the cutter head during its travel. To get over this difficulty, two angle irons *A* were fastened to the bench and the screws *B* supporting the shaft clamps set between them, while the screws *C*, supporting the cutter head of the machine, were made fast to the bench.



ARRANGEMENT OF POWER DRIVE

It will readily be seen that in operation the cutter head was held stationary and that the feed screw *D*, instead of feeding the cutter head along the bar, fed the bar to the cutter head by pulling the rear part of the machine along while the screws *B* were sliding on and being guided by the angle irons.

USING MECHANICAL HANDS IN THE SHOP



Johansson Angle Blocks and Other Precision Instruments

SPECIAL CORRESPONDENCE

AFTER an absence of 35 years, C. E. Johansson has returned to this country bringing with him from his Eskilstuna factory in Sweden some special precision instruments to supplement and broaden the scope of his standard blocks which are marketed here by C. E. Johansson, Inc., 245 West 55th St., New York City.

The set of angle blocks shown in Fig. 1 is probably the one of these new instruments which seems to have the widest field. This set is about the same size as the standard set of size blocks but each block instead of having parallel edges has each of the four corners beveled off at a different angle. The angles have been

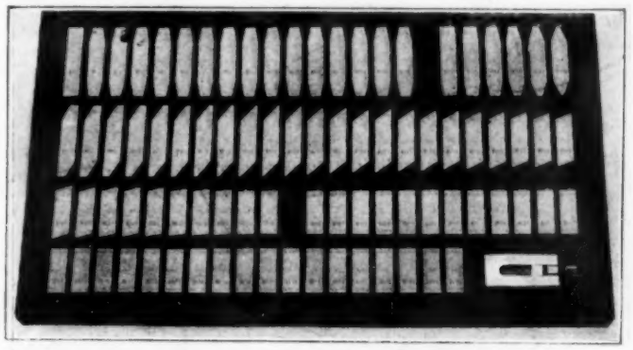


FIG. 1. ANGLE BLOCK SET

so worked out that combinations from 1 min. of arc to 270 deg., varying by minutes, are possible. These blocks can be combined with the regular size blocks for making gages for angular formed cutters, checking sine bars, etc.

Another set of blocks, Fig. 2, is of more interest to the scientist than to the manufacturer or toolroom foreman. The set consists of 11 flat size blocks claimed to vary by equal amounts from 0.100000 in. to 0.100010 in. As to just how one would use these blocks so that they would not be affected by the warmth of the body of the operator does not seem very apparent but the scientist who may use them will undoubtedly devise a means.

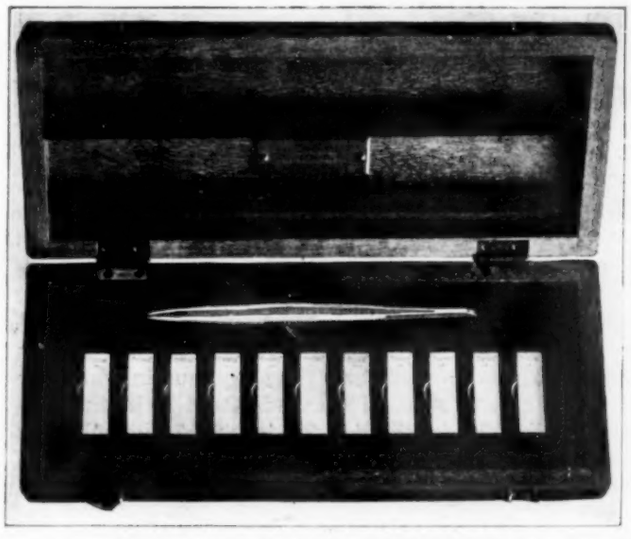


FIG. 2. SET OF MILLIONTH BLOCKS

Fig. 3 shows a laying-out and locating fixture for use

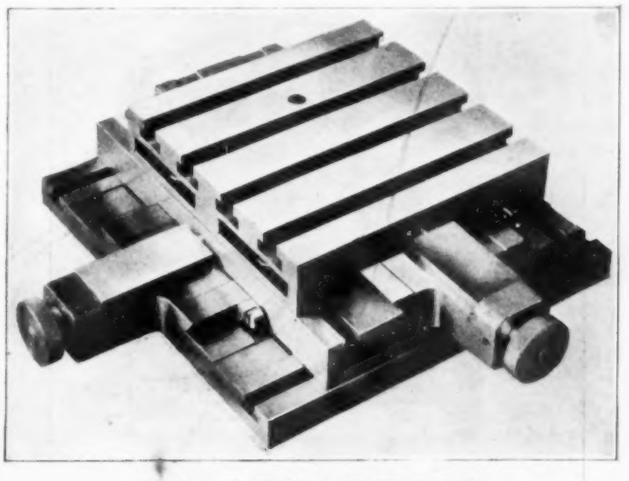


FIG. 3. LAYING-OUT FIXTURE

in combination with Johansson size blocks. The two movable beds are shifted by accurately cut screws ending in the large knurled nuts shown, and the size blocks are inserted between a carefully finished surface on the lower table and plug in the upper one. This fixture lends itself to a variety of uses in the shop and toolroom where quick and accurate work involving close measurements is to be done.

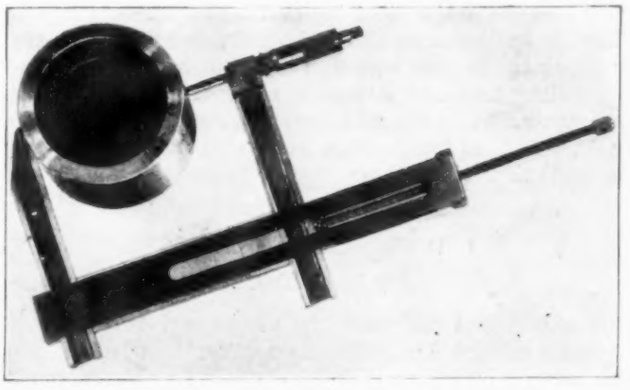


FIG. 4. COMBINATION MICROMETER CALIPER

Fig. 4 shows a combination micrometer caliper set made up of Johansson blocks, a pointer arm and an arm carrying a micrometer screw, all of which can be mounted in a frame with quick-acting clamp screw. This tool is singularly flexible in each of the four sizes in which it is made. For example, the 200-mm. or 8-in. size has four standard blocks, 25, 50, 50 and 75 mm. in width. This makes it possible to get 25, 50, 75, 100, 125, 150, 175 and 200 mm. as the zero settings for the micrometer screw or practically the range of eight microm-

eter calipers combined in one tool. For measuring large diameters or getting into deep holes, the jaws can be extended to their full capacity, while for jobs where rigidity of the caliper is the prime requisite, they may be withdrawn until only the screw of the measuring arm is outside the frame. The sizes made at present are the 100-, 200-, 300- and 400-mm.

The indicating micrometer caliper is also a practical shop tool and is illustrated in Fig. 5. The friction retained pointer is released by the knob so that rapid

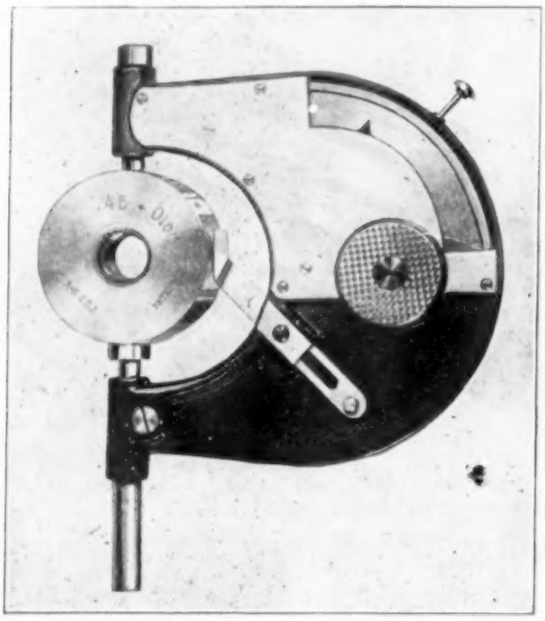


FIG. 5. REGISTERING MICROMETER CALIPER

readings can be taken while the work is revolving in the machine. If the light is poor the caliper may be carried to the light to be read, the setting being obtained without looking at the instrument. The caliper can be set at zero on a size block or on a master sample piece and the progress of the cutting determined by the distance on the scale from the pointer reading to the zero point. In this way readings can be taken behind a grinding wheel as it travels along the work and the feed controlled by the indicated closeness of the work to final size. This tool is made in several sizes to meet the demands of various shops.

Laying Off Punches

By E. A. Dixie

In punch and die work the almost universal rule is to make the die first. The reason for this is that the die being hollow is apt in hardening to change shape more than the punch. So if the die is made and hardened and the punch fitted to the hardened die the amount of distortion of the punch is usually so slight that it will either fit or can readily be made to fit by a few rubs with an oilstone.

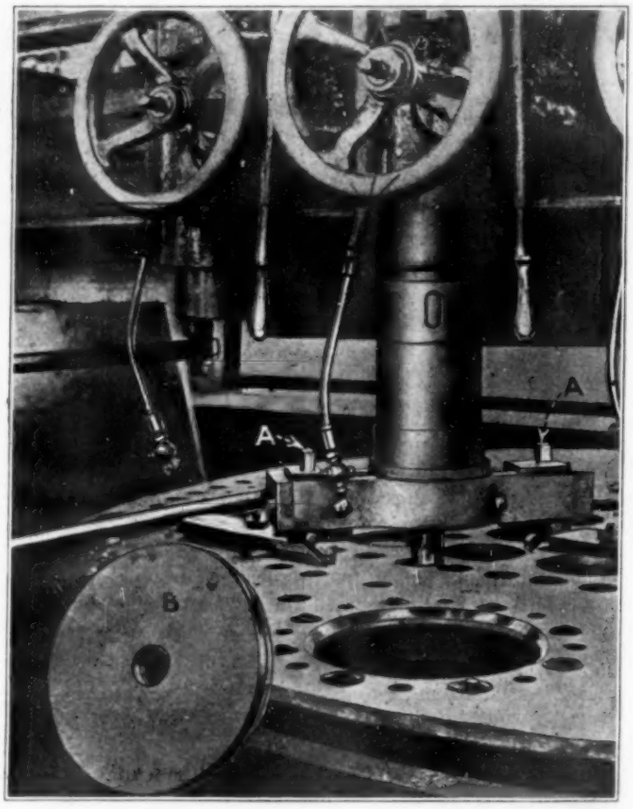
The punch is generally laid off from the hardened die. This is often done by placing the die on top of it and scribing through. With some simple shapes of dies this is easy but with dies which have very narrow slots and other openings it is practically impossible to accurately lay off the punch with a scriber. In cases of this sort or in fact for any shape of die the following method will be found to give an absolutely correct outline of the die on the face of the punch:

The face of the soft punch is first tinned and then a thin film of soft solder is floated over the face, say to a depth of $\frac{1}{64}$ in. The hardened die is now set in its bolster and adjusted in the press. The punch is set in the ram of the press and the flywheel of the press turned slowly by hand till the face of the punch comes in contact with the face of the die. The thin film of soft solder takes an exact impression of the die which can be readily followed by the diemaker.

Tool for Boring Flue Sheets*

By J. J. Sheehan

The tool shown in the illustration is fitted to the spindle of one of our drilling machines, and is used for the purpose of drilling and facing the steam-pipe-joint hole in the front flue sheet of locomotive boilers. This tool fits on the outside of the drilling-machine



TOOL FOR BORING FLUE SHEETS

spindle, and is held in place by a key fitted to the drift-pin slot in the spindle.

The cutters *A* are adjustable so that holes from 5 to 15 in. can be bored. The size of the steel used for the cutters is $\frac{5}{8}$ x 1 in. The tool is fitted with a pilot that fits into the hole which has been previously drilled in the center of the part to be cut out. The illustration shows at *B* the core cut from the sheet, and in which the pilot hole may be seen. The core is about 13 in. in diameter. It will be noted that the tool used not only cuts out the core from the sheet, but also bevels the edges of the hole to make a seat for the joint.

*From paper presented at the annual meeting of the American Railway Tool Foremen's Association in Chicago.

EDITORIALS

Publisher's Note

Owing to the unexpected prohibition of overtime by one of the printing trades in New York City this week, it has been necessary to cut down the number of pages in the present issue.

The Steel Strike

THE steel strike is on. What the outcome will be no one knows and neither side seems willing to venture a prediction. In any event the effect of the reduction in the output of steel cannot fail to be felt in many other branches of industry, to some of which it may well be disastrous if much prolonged.

The automobile manufacturers, to name but one of many classes of sufferers, are striving with might and main to catch up with their orders and few of them have more than a month's supply of steel ahead. Automobiles may not be considered as among the necessities of life although their ever-increasing use for business purposes would indicate their importance in our scheme of life, but the number of workers employed in the various branches of the industry ranks high in the list of American enterprises. These workers, when their supply of raw materials is cut off, will be up against a tough proposition with nothing coming in to pay for food and fuel, the prices of which will be climbing again as another result of the strike.

The President has taken time from his extended tour for the peace treaty to request the labor leaders to defer the strike until after the big labor conference to be held in Washington this month, and his request has been ignored. The head of the Steel Corporation has refused to recognize the professional labor men as representatives of the steel workers. While there may be several opinions as to the justice and wisdom of his course it is easy to understand his position when one reads the records of the strike organizers as published in the daily press.

It is significant that the largest number of recruits for the strike came from those of the foreign element who live like hogs, no matter what their pay, so that they can sooner save the predetermined stake which they will take home with them at the first opportunity. The American born and Americanized foreign-born men have shown little sympathy with the radical element so far. Why should they? They are among the highest-paid workers in the world and many of them own automobiles and comfortable homes and take their vacations in Maine. During the war their jobs were protected and they grew rich on overtime work. They may have been radicals before the war but they are now much nearer the conservative capitalistic class in status and sympathies.

Not all steel workers prospered equally but compared to the dollar-a-day soldier the least fortunate among them was rolling in affluence. Consequently, we may expect a certain amount of violent action when the discharged soldiers who have been sworn in as special police come in contact with these radicals who are making it more difficult for the returned service men. The supporters of law and order are full of militant Americanism and they are quite likely to impress some of it forcibly upon the striking alien. More power to them!

I am opposed to the zone system for the dissemination of news, ideas and information because I am of the opinion that the establishment and maintenance of such a policy would, in the long run, have a most unfortunate, harmful and regrettable effect upon the American people.—CONGRESSMAN FRANK W. MONDELL.

A Square Deal for the Engineer

THE increased cost of all that goes to make life worth living has been met, for the most part, by increases in wages. But little such relief has been afforded the salaried man, the man who may come under the head of non-productive, or at least the "indirect labor." This not only includes the clerical force but it also affects the designers, engineers and shop executives and even plant managers.

There are many engineers today who are of great value to their firms, who are getting but little more than before the war and whose work is handicapped by financial worry as to making both ends meet—not to mention lapping over a little, as they should. Needless to say, this is not a condition to obtain the best results of their capabilities and there never was a time when improved machinery and methods were so necessary to the future welfare of the world.

Because these men are making no specific demands, it is not safe to assume that they are content. As a matter of fact their unrest is as real as in any other phase of industrial activity. They are being forced to consider the possibility of securing their share of the general advance in income to meet the new level of expenses.

This condition brings them, among other things, to the careful consideration of the question of inventions and to question the moral justice of turning over all patents in consideration of a job and the mythical "one dollar in hand paid" which never materializes. There are of course several sides to this question; but the fact remains that no man, whose brains and experience (even when coupled with the facilities of the plant), have enabled him to devise a new, money-making machine, can ever feel satisfied unless a part of its savings finds its way into his pocket.

It is true that many inventors and designers never pay for the cost involved in developing their inventions. But no engineer expects something for nothing or an undue share of what he produces. He does object, however, and this objection is growing faster and more strongly than many realize, to an agreement which appropriates all that he accomplishes in exchange for a salary which, in these days, is too often inadequate for his needs.

It is always difficult to say just how much any one man is to be credited with the invention or develop

ment of a machine. But this can hardly justify the custom of appropriating the entire profits for the firm.

We happen to know several cases of glaring injustice of this kind and also that these and similar cases are stirring the engineers to consider ways and means of preventing similar occurrences in the future. In one case, the patents on a single machine were sold to an outside concern for a greater sum than the designer (and in this case it was all his work) received in salary in 15 years. And he never received even the "one dollar in hand."

In another instance a young engineer designed an entirely new instrument on which basic patents were allowed. This took the place of an instrument on which the firm was paying a royalty of nearly ten dollars per instrument. They not only refused to pay the engineer any royalty but had the bad taste to send him a check for *ten dollars* in recognition of his services. This is now framed in his own office as a souvenir of his former employer's generosity. And in neither case was the name of the inventor allowed to appear in connection with the work.

Far-sighted managers know the value of anticipating the just demands of labor. Here is an opportunity to smooth out the difficulties in a line which is of vital importance to our industries. Without the hearty cooperation of the engineer as well as the user of machines, our progress ceases.

Another Reason for Preparedness

AN ASSOCIATION of electrical engineers has just witnessed a demonstration of the application of wireless telephony and telegraphy to communication between submarine and airplane which makes one wonder what the next war will be like. The test was made off New London and the party on one of our destroyers was able to converse both with a submerged submarine and with an airplane above them, and also to listen in on conversation between the two.

Just suppose for a moment that the Germans had been able to direct the operations of a fleet of U-boats from the cabin of a Zeppelin floating a mile or so above them. What would have happened to the British grand fleet? How many transport loads of troops would have arrived in France? How many freighters loaded with food and munitions would have got through? Even as it was the margin between defeat and victory in the U-boat campaign was so slight at the time we entered the war that Admiral Sims' account of it makes one shiver at the thought of what might have been.

The announcement of achievements of this sort stirs the imagination. At the same time they should serve as a powerful incentive to keep alive the spirit of preparedness for whatever may befall, which was finally awakened by the war but which now shows signs of dropping back into the peaceful doze of 1916. Nothing could be more disastrous.

Lack of training of our man power is a serious fault but we have seen what intensive training can do to overcome it. Lack of material preparedness is a far different matter as we have also seen. The difficulties which beset our airplane program and held it back until our flyers had given up hope of taking a real American machine over the lines, and which kept us dependent on French and British guns and tanks up to the time of the armistice, must be faced again just as surely as we drift back into the old ways of thinking.

The American Legion, the Army Ordnance Association and similar organizations have great powers for good in protecting us from this backsliding, but after all it is the personal conviction of the individual citizen that counts. The manufacturer must take steps to keep his plant ready to revert to war work when the occasion arises; the workmen must not forget the craft learned under pressure, and, most important of all, the engineers, designers and technical experts must keep in touch with every development of war equipment and help the ordnance officers to keep us ahead of every one else in scientific methods and equipment for waging war and defending ourselves.

Add to the more or less familiar agencies of destruction the dangers of the misuse of the tremendous potential power in atomic energy as hinted at by Sir Oliver Lodge in an address in Birmingham and we get a sum total to make a thoroughgoing pessimist expire from sheer bliss. Fortunately, we have not as yet discovered how to use this atomic energy. Let us join Sir Oliver in the pious hope that we will not do so until the world has brains and morality enough to use it properly.

Cheap postage on periodicals and newspapers has made the American nation a nation of readers beyond any nation in the world. If there is any thought in your mind that this is not a national benefit, I ask you to compare in your mind this great country with its splendid and homogeneous American idealism, its singleness of purpose and the universality of its achievements with those nations in which there is but little magazine reading.—SENATOR ARTHUR CAPPER.

Trained Men Do Not Just Happen

EVERY little while we hear complaints as to the inability to get good men for certain kinds of jobs. Operators of machines of various kinds are not so difficult to secure, at a price, but when it comes to getting men who have had a wider experience, who can exercise a little initiative and keep things moving when something happens to the schedule, that is a different matter.

There is no doubt that this is a real complaint, and that it ought to be remedied. But who is to blame and where are such men to come from?

We gave up the old apprenticeship because we no longer needed all-round men in modern manufacturing methods. We also gave up the training of almost all kinds of men except for one special job. And in so doing we gave up an opportunity of getting the kind of men we need for special places. We hesitate to train men because someone else may induce them to leave us—and then we wonder why it is difficult to get the right kind of man when we want him.

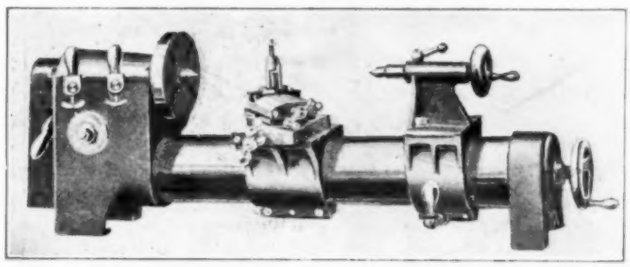
Men who can be of special value have to be trained; they do not grow. If we train our share of men, we stand a good chance of getting some other trained man when we need him, because there will be a large supply to draw from. If we cannot hold them after we train them, there is need to look after our methods of management.

If you are having trouble to get the men you need, it is well to ask whether you are training your share of such men. And it may be well to make your neighbor see the advantage of training his share of men, instead of laying wait for yours as fast as you get them to the point where they are of value.

SHOP EQUIPMENT NEWS

Urban Precision Bench Lathe

The Ohio Tool and Machine Co., 2300 St. Clair St., Cleveland, Ohio, is manufacturing a self-contained precision bench lathe of the unusual design illustrated. The cylindrical bed is ground to exact size, and is provided on the under side with a ground guide bar with large wearing surface for guiding the carriage and



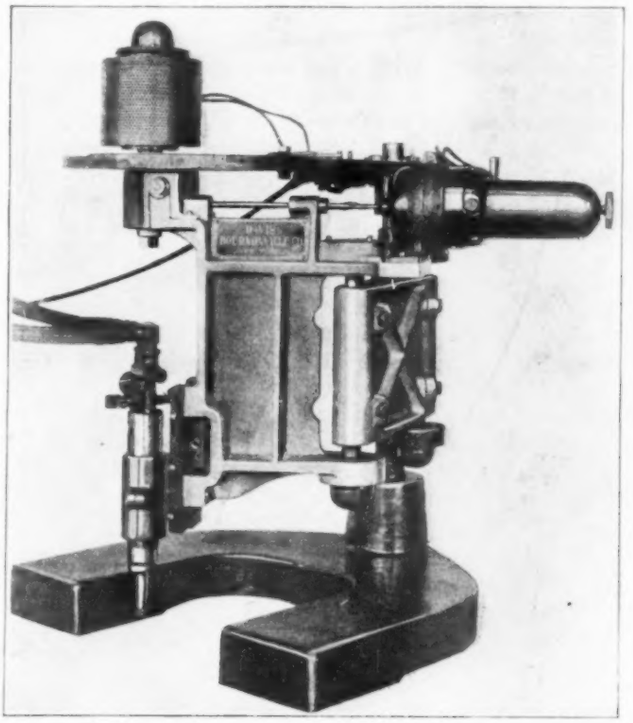
URBAN PRECISION BENCH LATHE

Specifications: Swing over bed, 8 in.; swing over carriage, 6 in.; hole through spindle, ¼ in.; size of tools, ⅜ x ⅜ in.; ball-bearing spindle; tailstock spindle diameter, 1 1/16 in.; travel, 2¼ in.; centers, Morse taper No. 2.

tailstock. Five selected speeds and one reverse are furnished. The motor is built into the headstock and direct-connected to the spindle with worm gearing that is inclosed and submerged in nonfluid oil. There being no belts or countershafts, the lathe can be set up anywhere and power taken from a lamp socket. A quickly attachable grinding wheel is furnished for grinding the tools. The lathe is built in three sizes, the one illustrated being the middle size.

Davis-Bournonville No. 2 Camograph Oxy-Acetylene Machine

A late development of the Davis-Bournonville Co., Jersey City, N. J., is a welding and cutting torch known as the Camograph No. 2, that is automatic in operation and is used for cutting openings in steel plates that cannot be done conveniently or economically on a drilling machine. The torch is mechanically traversed over a fixed path and at a predetermined speed. The path followed is controlled by an internal cam at the top of the machine, the shape of which determines the shape of the opening being made, the double-jointed radial arm permitting universal movement of the flame which perforates the steel. The principle of the cam guiding action is unique. The feed roller is magnetized by a powerful electro magnet, and is thus attracted to the inner face of the cam, the parts in contact being made poles of the magnet, one of which rotates and thus acts as a traction driver. The roller is driven by



DAVIS-BOURNONVILLE NO. 2 CAMOGRAPH FOR CUTTING OPENINGS IN STEEL PLATES

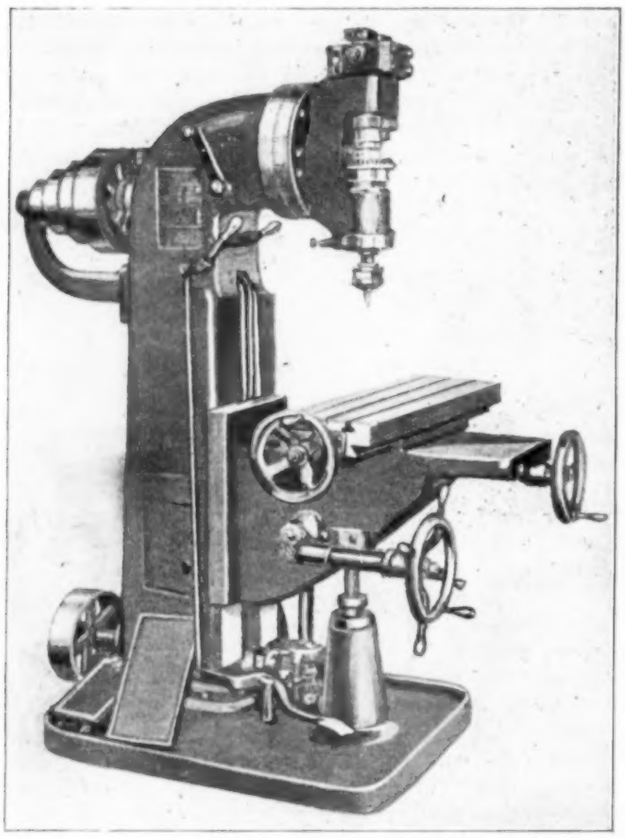
Specifications: Width, 17 in.; depth, 15 in.; height over all, 25 in.; electric current, 110 v. d.c.; net weight, 125 lb.

a small variable-speed motor through double worm gearing, the magnetic attraction being sufficient to cause it to travel along the face of the cam in a positive manner. Direct current is required owing to the magnetic feature, and the control consists of a double

push-button switch for starting, stopping and also for energizing the magnet. Arrangement is provided whereby when the cutting oxygen is turned on the feed motion automatically starts. The nominal diameter of the largest hole cut with the No. 2 Camograph is 7 in. but openings other than circular, having one dimension much larger, may be provided for. All thicknesses of plate used on the largest marine boilers are readily cut with this machine.

Daly Combined Die Sinking, Milling and Cherrying Machine

This combination machine, marketed by the Riverside Machinery Depot, Detroit, Mich., is of massive construction, the headstock being 15⅞ in. in diameter and graduated in degrees. Adjustable taper bronze bearings are provided 3⅜ in. at large end and 2⅜ in. at small end. The main spindle is made of high-carbon steel with ball bearings at each end. A large oil reservoir furnishes ample lubrication. The knee has a long bearing surface



DALY MILLING AND CHERRYING MACHINE

Specifications: Height over all, 7 ft. 2 in.; base dimensions, 3 ft. 9 in. x 2 ft. 10 in.; vertical travel of knee, 22 in.; cross movement of table, 16 in.; longitudinal movement of table, 32 in.; size of table over all, 39¼ x 13 in.; net weight, 4700 lb.

on the frame, is counterweighted to prevent vibration, and is raised by a power feed at a speed of 8½ in. per minute when fully loaded. The rotating table is hand operated and requires 40 turns of the handle to one revolution of the table. The main table is moved by hand power only and is fitted with three $\frac{11}{16}$-in. T-slots. All handles are within easy reach of the operator, are graduated and equipped with ball-thrust bearings. The cherrying attachment is incorporated into the revolving head and driven from the main shaft through a train of bevel and spur gears. The head is designed for cutters ranging in size from $\frac{3}{16}$ to 6 in. in diameter. The slotting attachment is furnished as an extra. The knee is supported by telescoping screws running in ball thrusts, the screws being 3 in. and 1¾ in. in size respectively. The cone pulley is designed for a 3½-in. belt, the largest cone step being 14 in. in diameter. It has a built-in friction brake to insure quick stops. Sliding gears furnish a total of eight spindle speeds. When motor drive is required a 5-hp., four to one, variable-speed motor is furnished at the same price, except for the cost of motor and electrical equipment.

The Silver Radial Drilling Machine

The radial drilling machine placed on the market by the Silver Manufacturing Co., Salem, Ohio, has a number of interesting structural features, in addition to a well-balanced design as shown by the illustrations. The base is of substantial construction, being heavily ribbed both ways, and provided with T-slots and oil channel. The column is of semi-steel ground to size, the inner column or post being reinforced inside by heavy

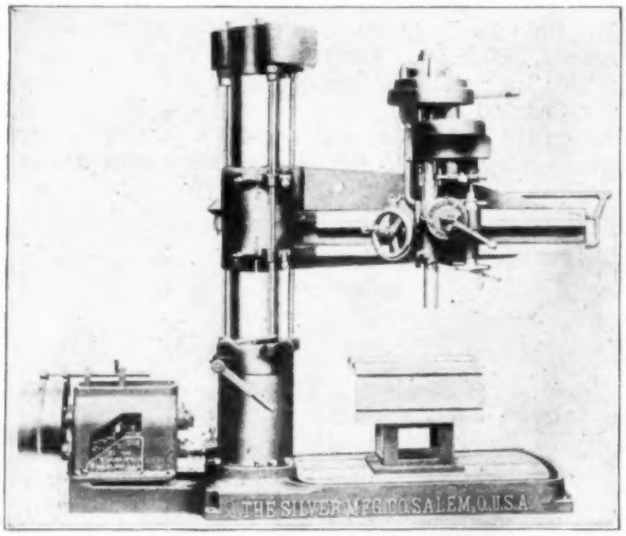


FIG. 1. SILVER MANUFACTURING CO.'S RADIAL DRILLING MACHINE

Manufactured in three sizes to the following specifications: Sizes, 2½ ft., 3 ft., 3½ ft.; working surface of base, 31 x 33 in., 31 x 39 in., 31 x 45 in.; drills to center of 5 ft. 6 in., 6 ft. 6 in., 7 ft. 6 in.; traverse of head on arm, 23 in., 29 in., 35 in.; height of base, 6½ in.; traverse of arm on column, 29 in.; maximum distance spindle to base, 50 in.; column diameter of outer sleeve, 9 in.; spindle traverse, 12 in.; Morse taper No. 4; maximum distance spindle to floor, 9 ft.; working surface of table, 16 x 22 in.; height of table, 19 in.; drive pulleys, 14 x 3¼ in.; net weights, 4250 lb., 4400 lb., 4560 lb.

ribs running nearly the full length. The outer column telescopes the post and rests on a ball-thrust bearing. The radial arm is designed to resist torsional and bending strains, is raised and lowered by power and is provided with automatic "knockout" at both limits of travel.

A special feature is the arrangement for clamping the arm to the column. Two lever-operated bolts are used to tighten the clamps. The bolt serves several purposes. It is constructed to act as a limit screw to prevent sagging, besides acting as a binder. In addition to this when the lever is placed in a clamping position, it tightens the split hub through which the controller shaft runs. The elevating screw is thus prevented from being set in motion while the arm is clamped to the column. Another feature is the safety

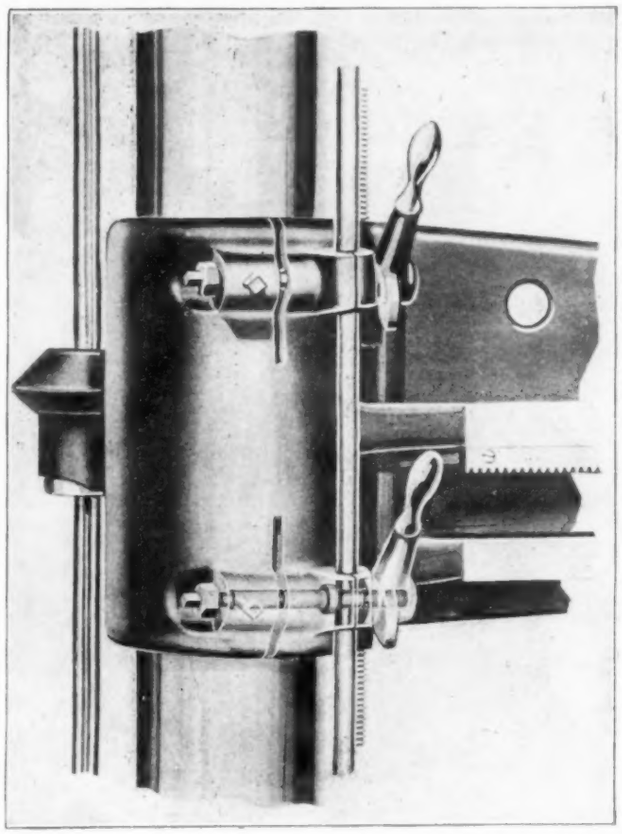


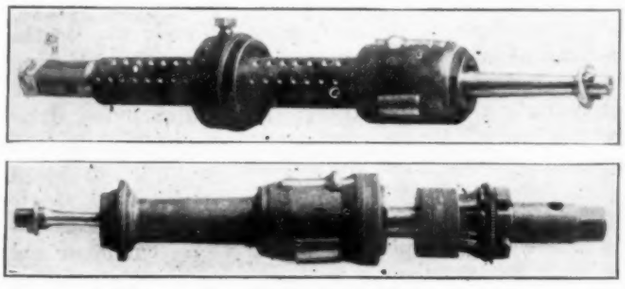
FIG. 2. LOCKING ARRANGEMENT ON SILVER DRILLING MACHINE

nut that prevents the arm from dropping when the threads become worn in the elevating nut.

The head is arranged for rapid travel along the arm, and contains a two-speed back gearing that may be shifted while running. The spindle is double splined, runs in phosphor-bronze bearings, and has a ball-thrust bearing. The rack teeth are cut directly into the sleeve. Any one of eight feed changes may be obtained while drilling by two convenient handles. Other refinements are supplied such as a depth gage, automatic feed trip and tapping attachment. The quick-change gear box permits of running the gears in an oil bath, and six speed changes are obtainable, which with the back gears of the head provide 12 speeds in all.

Faessler Boiler-Tube Expanders

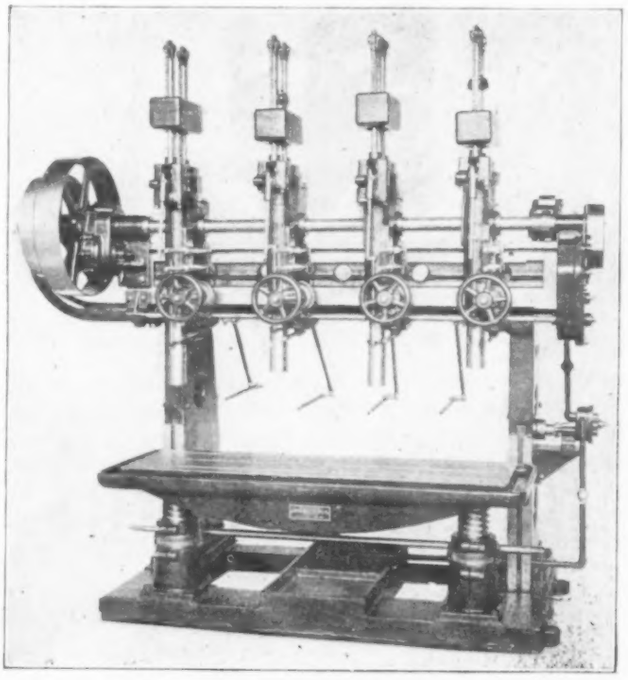
The boiler-tube expanders illustrated herewith are manufactured by the J. Faessler Manufacturing Co., Moberly, Mo., and are late additions to its line of boilermakers' tools. These expanders both serve the same purpose under different conditions, their function being to roll the tube tight in the sheet and flare the end without removing the tool. Fig. 1, with the mandrel stop collar omitted, is intended for use where the tube must be expanded through a water space, such as locomotive arch tube and water-tube boilers. Fig. 2 is to be used where there is no water space to contend with. The operation is identical in both cases. The expander is placed in the tube with the flaring roller just clearing the tube end. The expander is self-feeding, and the mandrel must be turned to the right until the tube is rolled tight in the sheet. To flare the tube, the mandrel stop collar shown in Fig. 2 is placed against the roller cage, which stops expansion by preventing the mandrel from entering the tube further, and by continuing to turn the mandrel to the right, the expander is forced farther into the tube until the flare is produced by the action of the flanged roller. To remove the expander, the mandrel is turned to the left. If it is desired to bead the tube, a hand or air-beading tool is used in the usual manner. The expanders are made of heat-treated and tempered steel and it is claimed they do not pinch or thin the tube at the bottom of the flare. The expander, Fig. 1, is made for tubes ranging in size from 2½ to 4½ in., while the other, Fig. 2, has a range of 2½ to 4 in. in size.



FIGS. 1 AND 2. FAESSLER BOILER-TUBE EXPANDERS

Harrington Multiple-Spindle Drilling Machine

Edwin Harrington, Son & Co., Inc., Philadelphia, Penn., is manufacturing a multiple-spindle drilling machine, similar in design to its No. 15 and No. 16 types but smaller in all respects. It will appear in its catalog as No. 17. The machine has a capacity to drive at one time, in mild steel, four 1-in. drills, or a less number of larger size drills. The spindle heads have independ-



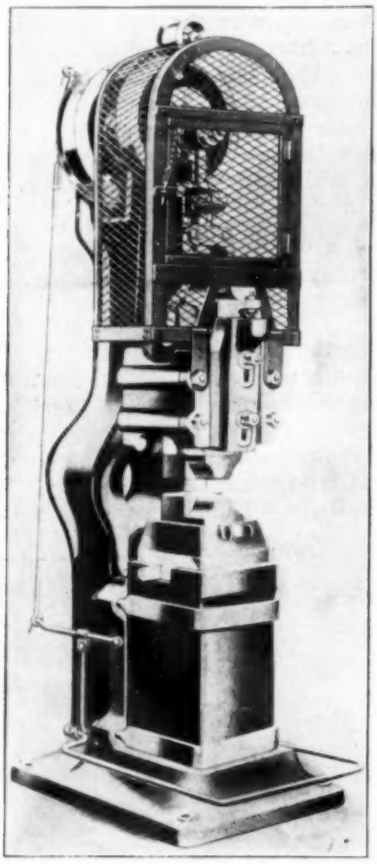
HARRINGTON NO. 17 MULTIPLE DRILLING MACHINE

Working surface of table, 5 ft. 1 in. x 18¼ in.; shortest distance between spindles, 5½ in.; greatest distance between end spindles, 4 ft. 10 in.; vertical traverse of spindles, 10 in.; vertical movement of table, 13 in.; clear opening between uprights, 4 ft. 9 in.; Morse taper, No. 4; countershaft pulleys T. & L., 20 in. x 5 in.; size of motor, 10 hp.; floor space, 8 ft. 4 in. x 4 ft. 1 in.; height over all, 7 ft. 11 in.; net weight, including countershaft, 6150 lb.

ent lateral adjustment by means of a rack and pinion arrangement and may be clamped in position by bolts in the T-slots of the crosshead. The speed can be varied to suit requirements, but operates at the same rate on all spindles. A two-step cone pulley is used to drive direct or through back gears, permitting four changes of spindle speed. Where an adjustable-speed motor is used, a single pulley is provided with or without back gears.

Safety Guard for Power Hammers

Safety guards for the protection of workmen are now universally recognized as a necessity, and, with this idea in view, the United Hammer Co., Oliver Bldg., Boston, is manufacturing guards for all sizes of Fair-



SAFETY GUARD FOR POWER HAMMERS

banks power hammers up to and including 500-lb weight of ram, the 400- and 500-lb. sizes being recent additions to its line that were brought out for the heavier classes of work, such as found in locomotive shops, shipbuilding plants, etc. The guard, as shown, covers all working parts of the machine, the door permitting easy access. The guard can be easily attached to hammers now in operation as well as to new ones.

The Woods Plain Grinding Machine

The plain grinding machine here described and illustrated is the product of the Woods Engineering Co., of Alliance, Ohio. The maximum size of the grinding wheel is 8-in. face by 20-in. diameter and the centers take work 15 in. long by 10 in. in diameter. The machine occupies a floor space of 6 x 6 ft. and weighs

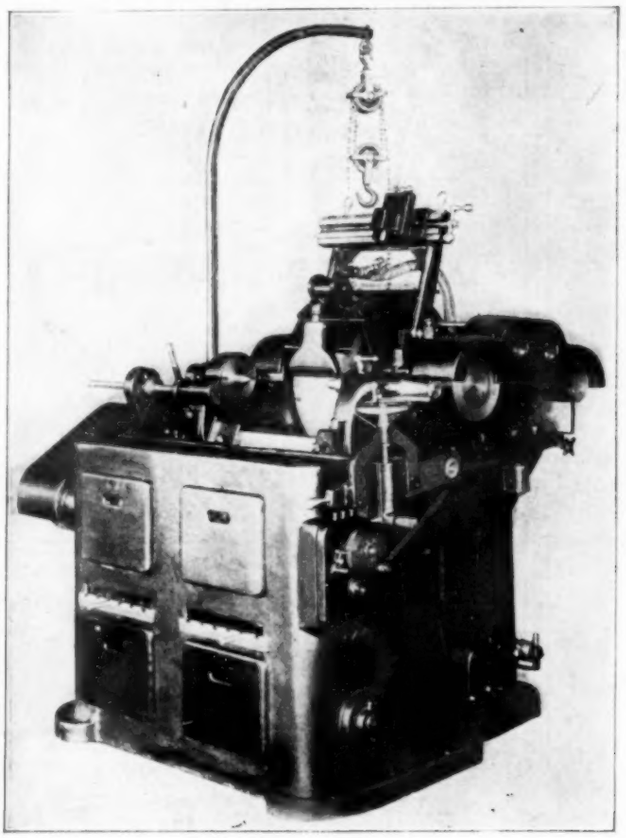


FIG. 1. THE WOODS PLAIN GRINDING MACHINE WITH ROCKING CROSSFEED

6000 lb. The method of crossfeed is an unusual feature as this is accomplished by a rocking motion instead of the usual dovetail or V-slide arrangement. The headstocks and tailstocks are moveably mounted on a square shaft having journals at the ends which operate in bronze-bushed, pedestal-type, dust- and grit-proof bearings. Clamped to the shaft is an arm which carries the mechanism for making the diameter adjustments in grinding. This arm is shown at the right side of the machine in Fig. 1, where the 6-in. handwheel is in convenient position for the operator. This being the only handwheel, the manual labor in operating the machine is reduced to a minimum.

A shaft passing through the housing parallel to the square shaft carries on the right-hand end a cam that controls the movement of the arm connected to the square shaft and governs the movement of the work to the grinding wheel. This cam has six speeds ranging from three revolutions in one minute to one revolution in three minutes, one revolution being required to complete a job. In operating the machine this camshaft is kept running continuously, which sets the pace for the operator, or if it is necessary the trip can be set to trip the feed at the completion of each job, or the feed can be tripped by the operator at any time during the revolution of the cam. At the left-hand end of the camshaft is a cam that controls the clutch pulley driving the work. These two cams are timed with each other so that when the work moves up to the grinding wheel, the clutch pulley is engaged and the work starts rotating just before coming in contact with the grinding wheel. When the grinding cycle is completed and the work moves away from the wheel, it stops rotating and comes back to a position for reloading.

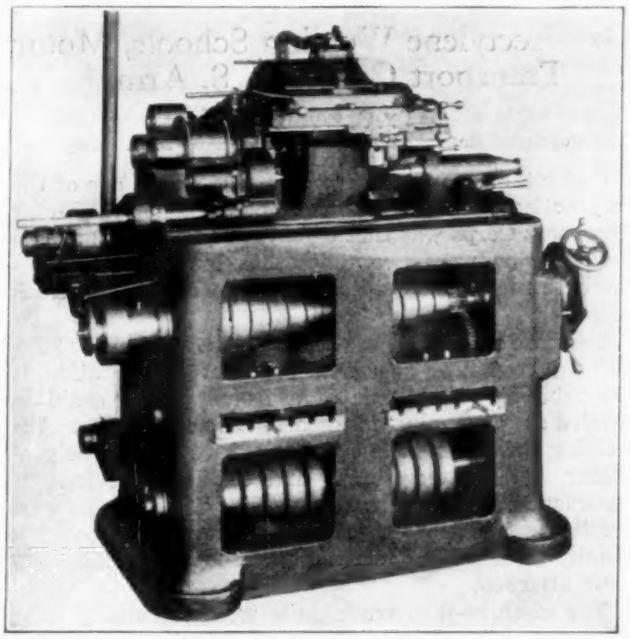


FIG. 2. SHOWING TRUING DEVICE IN POSITION AND HOUSING COVERS REMOVED

Six speeds for the work are obtained by a set of cone pulleys inside the base of the machine. The speed changes for both the work and camshaft are made by shifting the handles projecting through the front.

The grinding wheel is mounted on the spindle between the bearings and is driven by two 4-in. belts from a motor mounted on the base of the grinding-wheel head. This head is arranged to swivel on a central stud for grinding taper work. The grinding wheels are carried on wheel centers and in changing wheels it is not necessary to break the adjustments of the spindle bearings or remove any pulleys, the wheel centers having a bore large enough to pass over all other parts on the spindle. For truing the grinding wheel, a frame is pivoted on the casting which forms the wheel guard. This frame carries a dovetail slide arranged to swivel, and a carriage with a crossfeed movement carries the diamond holders.

To operate the work centers are lowered by removing the hardened pin that bears on the cam, permitting the truing frame to swing down to a positive stop which brings the diamond on the same plane as the work contact.

As to the production from this machine, a typical job is the grinding of twist drills: In grinding No. 1 Morse shanks, it is claimed the machine will produce 150 per hour; on No. 2 Morse shanks, 120 per hour; the barrels of $\frac{3}{8}$-in. T. S. carbon drills are produced at the rate of 120 per hour, and the barrels of $\frac{1}{4}$-in. drills, at 100 per hour. From all of the examples given, from 0.009 to 0.012 in. was removed with a limit of 0.001 inch.

Michigan Cylinder Reboring and Burnishing Tool

This tool finishes the interior of cylinders by practically the same method as that used by manufacturers and is the product of the Michigan Machine Co., Detroit, Mich. Its function is to rebore and burnish a cylinder, leaving the walls glazed and free from tool marks and thus providing good bearing surface at once

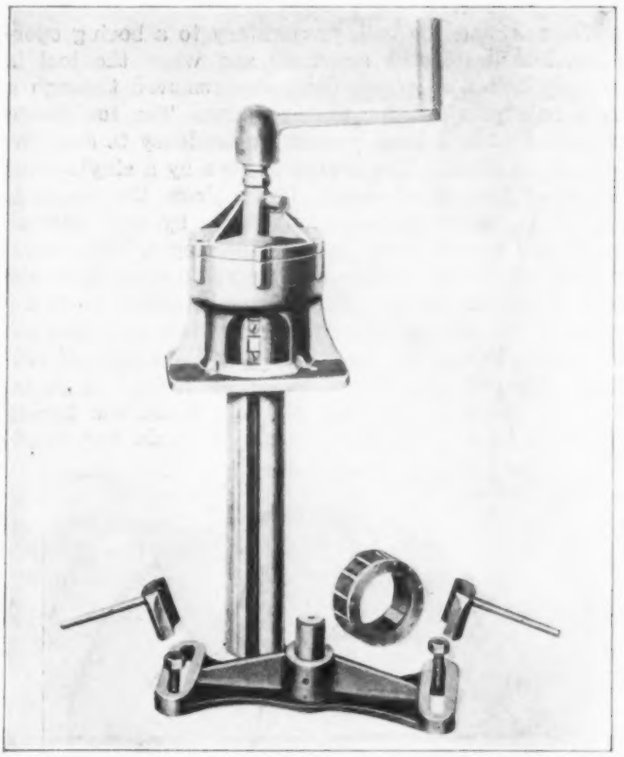


FIG. 1. BORING AND BURNISHING TOOL COMPLETE.

without requiring the customary "wearing in" process to get a good compression. The tool is intended for use in connection with the Fordson tractor and Ford model T engines only and is said to have the endorsement of the service department of Henry Ford & Son, Inc. It is light and portable, of simple construction and has comparatively few parts. It can be operated either by hand or power, as a crank is furnished for hand operation and a universal joint suitable for any drill press can be used where power is available.

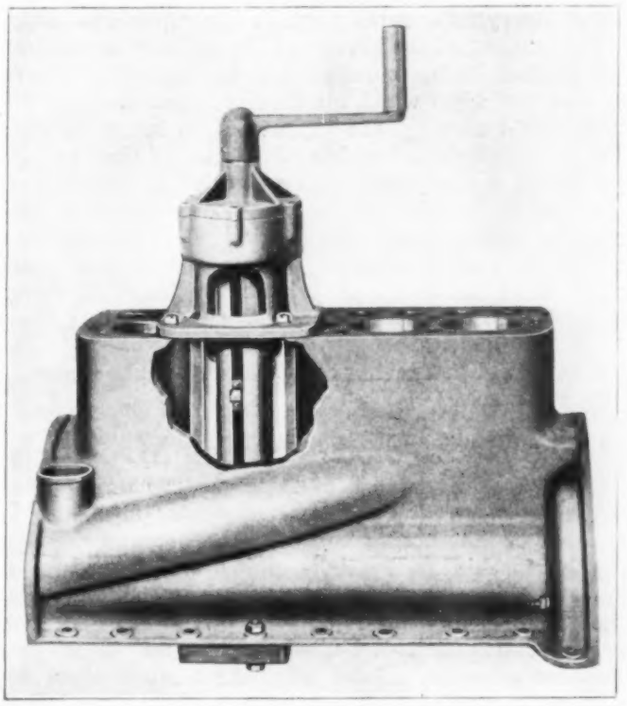


FIG. 2. SHOWING BORING TOOL IN WORKING POSITION

When setting the tool, preparatory to a boring operation, locating blocks are used and when the tool is securely bolted in place, these are removed through a hand hole provided for that purpose. The tool being supported at both ends prevents a tendency to creep or bore at an angle. The boring is done by a single-point cutter of high-speed steel. Power from the crank is applied to the feed screw and sleeve by two internal gears and two pinions, these imparting a differential motion that causes screw and sleeve to operate in the same direction but at different speeds, which gives the proper feed action and at the same time produces the desired resistance of the tool during the strain of cutting. The differential motion causes a feed of $\frac{1}{64}$ in. for each revolution of the sleeve. When the boring operation is completed, provision is made for disengaging the cutter from the work and returning it to the top of the cylinder rapidly and in a straight line.

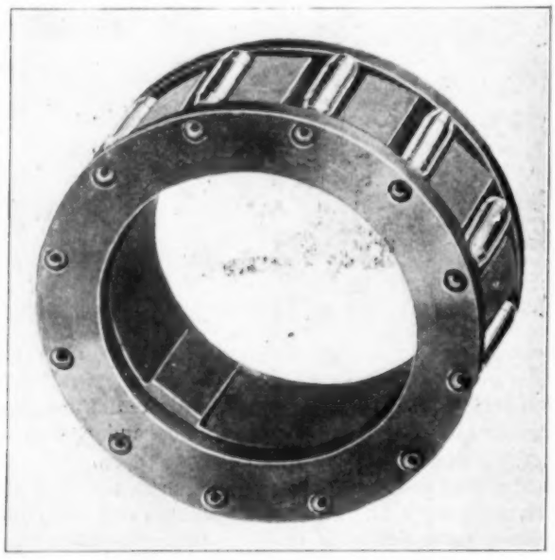


FIG. 3. BURNISHER FOR BORING TOOL

The support at the bottom of the cylinder is removed and the burnishing tool applied to the boring-tool sleeve by means of a key which fits the slot in the sleeve. This being self-centering, the support is no longer needed. The burnishing tool consists of a series of floating rollers, set at a slight angle and supported by two collars. The angular position of the rollers causes them to feed properly through the cylinder bore. It is claimed that the average time required to bore four cylinders by hand is 1½ hr. and that 1 hr. is sufficient if power is used; also that the cutter is capable of boring from 20 to 30 cylinders before regrinding is necessary. The tool is packed in a tool box that can be used as a permanent receptacle.

Pilocollan Method of Setting Machinery

The Pilocollan method of fastening machines to the floor does not require the use of screws or bolts. It consists of interposing between the floor and the foot of the machine a specially prepared felt pad of a variable thickness according to the size and weight of the machine. Both sides of the pad are coated with a preparation that is heated for use and on cooling becomes adhesive. Many advantages are claimed for this system which is being introduced by Dr. George Wettstein, of the Swiss Consulate, New York.

Oxy-Acetylene Welding Schools, Motor Transport Corps, U. S. Army*

By C. K. Bryce,
Formerly Major, Motor Transport Corps, U. S. Army

Under the expanded program of the Army, one of the very noticeable shortages in the personnel of the Motor Transport Corps was that of oxy-acetylene welders. In this division were two units that included welders—the base repair shop units and the machine shop truck units.

The base repair shops were large shops of about 250,000 sq.ft. of floor space, in which every operation in the rebuilding or repair of a motor vehicle could be carried on. Naturally, an important department was the welding shop. This was equipped with an acetylene generator, torches, regulators and auxiliary devices, in accordance with the latest practice. These shops were erected and located in proportion to the motor-vehicle requirements of the territory or troops to which they were attached.

The machine-shop truck units were essentially small machine shops on wheels. The principal truck had mounted on it, a lathe, drilling machine, grinding machine and other tools for automobile repair and upkeep. In the equipment was included a complete oxy-acetylene welding and cutting outfit. Attached to the underside of the truck body, were two oxygen cylinders and one acetylene cylinder. These mobile shops were used for emergency repairs, which were not practicable to put through the base repair shops. Each army had a certain number of these units assigned to it.

On surveying the welding talent necessary to fill these units, less than 100 welders were available. From the tables of organization, it was estimated that between 1500 and 2000 would be required in six to eight months' time. The usual channels of draft, induction, enlistment and transfer from other corps being discontinued, it was apparent a new source must be created.

Organizing the School

In May, 1918, after considerable activity on the part of Col. J. W. Furlough, deputy chief, Motor Transport Corps, the organization of a welding school was started. This school was divided into three sections, one to be located at each of the three base repair shops then in process of erection in this country; namely, Camp Holabird, Md., Camp Jessup, Ga., and Camp Normoyle, Texas.

Each school was laid out to accommodate a class of 100 welders, with provisions to increase this to 150. The buildings consisted of a school building proper, and an oxygen and acetylene house. The main building was divided into a welding room, lecture room, offices, stockroom and repair shop.

The welding room consisted of rows of stations, piped with oxygen and acetylene from a central source. Each station occupied 7½ x 6½ ft. of floor space, and consisted of a cast-iron welding table, torch, oxygen and acetylene regulators, hose, etc. The oxygen and acetylene were piped in headers between the rows of tables. Oxygen was distributed from a 30-cylinder manifold; acetylene was generated in a non-automatic generator at low pressure, and delivered to a 1000-cu.ft. gas holder; from there it was compressed in a single-stage com-

*A paper read before the Annual Convention, International Acetylene Association, New York, July 15-17, 1919.

pressor to about 10-lb. pressure. After passing through suitable regu'ating and relieving devices, the gas entered the station headers.

The course of training was from six to eight weeks' duration. The actual welding time averaged about 260 hr. In addition to this, there were about 30 hr. of lectures and talks. A course of 60 standard problems, selected to cover the motor-truck welding field, was selected. These problems covered steel, cast iron, malleable iron, aluminum, brass, bronze, copper, brazing and lead burning.

The students were compelled to perform each problem satisfactorily before progressing to the next. Every morning they were given a short talk on the technical factors involved; on Saturday morning they were questioned on the week's work.

The training progressed by weekly grading, which allowed a flexible and continuous scheme of instruction. At the beginning of each week, a green squad of from 10 to 14 men entered the school. At the end of each week, a finished squad was graduated. The new men would be taken in charge by the instructor supervising the first week's training. At the end of this time, provided their work was satisfactory, they would be advanced to the next grade under the instructor in charge of the second week's training. The squads progressed in this manner week by week, under different instructors, until the entire course was covered.

This arrangement proved satisfactory, since it was possible for a student to advance more rapidly than his squad, should his skill warrant it, or in case he were backward, to progress at a slower rate. Also, another important feature which had to be considered was that of instructors. In this scheme, the instructors were specialized on a limited section of the training only. They could, therefore, be developed faster and more efficiently than if they were given more or less general training for the entire course.

After a student had completed a problem, it was inspected by the instructor, and where required, the weld broken and the fracture examined. The student was graded accordingly. These grades were recorded and averaged with the grades given in the lecture room. If, at the end of four weeks, a student who had entered as a private was above a certain average, he was recommended for promotion to private, 1st class. During the last week of training, this student was placed on practical jobs without any assistance from the instructors. This was in order that he attain confidence in his own ability to overcome difficulties.

When he had satisfactorily completed his practical work, he was given a written quiz, to refresh his mind on essential points. He was then awarded a certificate and relieved from the welding-school detail, and held ready for assignment to duty. In active service the Motor Transport Corps graded the welders from corporals to sergeants, senior grade, the average grade being sergeant. The sergeants, senior grade, were foreman welders connected with the welding department of the base repair shops. The corporals were helpers.

The Camp Holabird school, which was the only one in operation at the time of the armistice, was housed in a three-story distillery building, and had several months' start on the others, which were abandoned.

It was shown, in this method of training, that the difficulty connected with the production of welders was more or less imaginary. Of the men received—and these were not selected because of any particular qualifications—there were only about 8 per cent. rejections. In practically all cases this was due to disinclination rather than inability to absorb the training.

In proportioning the course, three and one-half weeks were spent on steel, two weeks on cast iron, one week on aluminum and the remainder on miscellaneous metals. Steel being the first metal tackled by the student, more time was spent on this, in order that he thoroughly master the fundamentals. Aluminum welding was grasped quite readily, as was also cast iron.

The welding school originally conceived for emergency training, now fits in nicely with the educational plans that have been adopted for peace-time service. Recruits are given the opportunity of learning one or more of the trades connected with motor-truck operation and maintenance. Oxy-acetylene welding has met with its share of popularity and it is believed that the school will be filled to its capacity at all times.

Removal of Safety Devices by Operatives

By A. F. Guyler
Beeston, England

On pages 396 and 848, Vol. 50, of the *American Machinist*, reference is made to the removal or non-use of safety devices by the operator using the tools, and H. J. Gustav Kopsch, on the latter page, gives as the operator's reason for this that the devices interfere with production.

Although this may be the case in some instances, the advantages of the removal are not always obvious, and in some cases the only reason which can be ascribed to the fact of a guard being out of place is laziness. What other reason could one give; say, for instance, where a milling-cutter guard has of necessity to be removed for setting up a new job and is not replaced, although it would not interfere with the operation of the machine and the machine would not require to be reset for two or three weeks? Yet anyone in a machine shop knows that the operators have to be continually reminded of these things.

Again, what increase in production is obtained by the wearing of loose and baggy garments? Apparently, the only cure for this sort of thing is a "narrow shave." I have seen several of these and they appear quite effective, but they sometimes go too far.

In one case, a scarf worn with the ends loose caught in the lathe dog which, fortunately for the man concerned, was in use on a piece of small diameter. The lathe had an overhead belt-shifter and, his head being pulled down, the man was unable to reach this. His call for help brought a fellow workman who stopped the machine just as his throat touched the work—quite near enough to effect a cure for wearing a loose scarf in that man.

Some firms provide their female operators with caps to cover the hair and, while "consenting" to wear them, a tuft of hair will usually be observed protruding from under the cap—probably with the idea of taking away the "swimming cap" appearance of the headgear. Sometimes, in the case of operators on the sensitive drills, it will be noticed that all the caps are being worn as they were intended, and a search will then reveal one operator with a bruise in the center of her forehead and a small red mark where the hair *was*.

Sparks from the

The Cleveland Milling Machine Co. Opens New Offices

Indication of the expansion proposed by machinery interests in Cleveland is seen in the announcement of new offices being established by the Cleveland Milling Machine Co. L. H. Mesker, vice president of the company, announces the appointment of H. L. Clark as representative of the firm in New York City. Mr. Clark, who was doing government work during the war at the Watervliet Arsenal, will also cover the Boston territory. Howard Locker has been appointed to represent the Cleveland Milling Machine Co. at Detroit, and will cover Michigan territory. The Brownell Co. will represent the firm in the district adjacent to Providence, R. I., handling cutting and milling machines, and the Beals-McCarthy Co., Buffalo, N. Y., will distribute its cutters in that section.

* * *

World's Coal Shortage About 62,463,000 Tons

The world's coal chortage amounts to approximately 62,463,000 tons, according to the estimate of the Shipping Board.

"We have figured that the total amount of coal available for export in countries other than the United States is 97,723,000 tons; that the total needs of all the countries are approximately 170,511,000," said H. Y. Saint, head of the export department of the Shipping Board. "That leaves a total to be supplied of 81,788,000 tons. Now, subtracting the pre-war exports of the United States, 19,325,000 tons, leaves an additional amount to be supplied of 62,463,000 tons.

"This shortage, we figure, includes 48,300,000 tons in Germany. Germany loses a large portion of her coal territory and, at the same time, burdens of 25,000,000 tons of exports are imposed upon Germany by the peace treaty.

"Taking these things into consideration, we have made up that total. We figure that Canada will need 16,853,000 tons. China needs 3,135,000 tons; France, 17,000,000 tons; Belgium, 12,000,000 tons; the Netherlands, 8,000,000 tons.

"The European situation is due to the falling down of the production in England. England was the great exporting coal nation before the war, and her exports have dropped from 67,000,000 tons to 23,000,000 tons, approximately. Italy got the great bulk of her coal from England. France received a very considerable amount. The northern neutrals got their coal mostly from England, and South America procured a great deal of her coal from England. In addition, England herself practically kept up the bunkering situation of the world.

"The Italian imports of coal before the war were approximately 10,000,000 tons. Last year, England sent to Italy approximately 4,000,000 tons, and this year she is, up to date, doing very little better. That leaves between 4,000,000 and 5,000,000 tons of coal to be supplied to Italy by other nations, and we are practically the only nation which can supply the coal. Consequently, we are relieving England to the extent of whatever coal we are sending to Italy, because that was supposed to be her part of the settlement over there—that she was to take care of that situation."

> ***I have neither urged nor considered this (the Postal Zone Law) as a party question. It involves a national principle affecting every man, woman and child in the Republic, and has never been considered in a partisan way by any one, so far as I know. I urged this repeal before the previous Democratic Congress, as I shall before the present Republican Congress — not on party or partisan grounds, but on the broad platform that such a policy tends to circumscribe and provincialize our national life to our great haven as a people. — Congressman Frank W. Mondell.***

* * *

Surplus of Brass Offered for Sale

The entire present surplus of brass held by the War Department, consisting of approximately 150,000,000 lb., is being offered for sale under sealed bids.

The zone and district offices of the various bureaus of the War Department holding title to surplus stocks of brass are issuing invitations to brass founders, brass machinists, brass rolling mills and waste-material dealers to bid on the stocks now for sale.

The brass offered for sale was acquired by the War Department for use in the manufacture of munitions, such as artillery cases, small-arms cases, point-detonation fuses and shrapnel fuses. The stocks consist principally of sheets, strips, bars and rods.

Information regarding the sale of this brass may be had by communicating with any of the district ordnance offices, or with the Chief of Ordnance, 6th and B Sts., Washington, D. C.

Urges Change Made in Wording of the Caldwell Bill

V. C. Kyleberg, acting chief of the machine-tool section of the office of the Director of Sales, in commenting today on the Caldwell Bill, urged that steps be taken immediately to change the wording of the bill so that machine tools could be sold to schools at 10 per cent. of the appraisal value instead of 10 per cent. of the cost.

It was pointed out by Mr. Kyleberg that, as the bill now stands, it would not be advantageous for schools to purchase equipment from the machine-tool section, particularly equipment that is rated in poor or fair condition. It will be necessary, however, that schools buy used machinery because the new machinery has almost all been sold and what is now left has a ready market.

"We are oversold," said Mr. Kyleberg, "and we are receiving large orders from abroad. Belgium alone has ordered more than 2000 machine tools."

If the schools and universities are to purchase machine tools from the War Department at 10 per cent. or 20 per cent. of their original cost, in many instances, Mr. Kylesberg pointed out, the schools would be paying more than the price paid for the same tools by the trade. This will be true because the articles in demand by schools have suffered a decline in the market price since they were bought by the War Department. Many of these articles were bought at the peak of inflation during 1918, and at present their market price is from 21 to 35 per cent., approximately, below the 1918 prices.

In the purchase of a commodity that had declined in price about 35 per cent. of its 1918 cost price, and which was rated at about 40 per cent. of its primary condition, it was said, that the schools would lose money on the transaction. In the purchase, however, of new machinery, this would not hold true, but the new machinery has practically all been sold.

Mr. Kyleberg urged that the wording of the bill be changed from cost to appraisal value so that the probable intention of the bill might be carried out. He said that unless this was done in the very near future there would be no machine tools to turn over to the schools and universities, because they were being rapidly taken up by the trade.

The General Staff announcement, as of Sept. 20, places the approximate value of surplus machine tools at $56,000,000, of which $41,000,000 represents standard tools and $15,000,000 special machines designed for the production of guns, ammunition or other military material.

World's Industrial Forge

By E.C.Porter, News Editor

International Machinery Exposition at Grand Central Palace

Considerable progress is being made with the International Machinery Exposition which will open soon a permanent display in the Grand Central Palace, New York City.

The exposition will include exhibits of manufacturers and selling agencies of engines, lathes, milling, planing, drilling, grinding, shaping and boring machines; hand and power presses; can-making, saw-making, tack-making and wood-turning machines, and many other automatic machines of various types.

* * *

August Exports Increased

Exports during August amounted to $76,000,000 more than in July, being valued at $646,000,000. In August last year the total was $527,000,000. For the eight months ending with August exports were valued at $5,275,000,000, against $4,009,000,000 for the corresponding months in 1918.

August imports amounted to $308,000,000, a decrease of $35,000,000, as compared with July, but a gain over the $273,000,000 recorded in 1918. For the eight months ending with August imports increased from $2,061,000,000 in 1918 to $2,263,000,000 in 1919.

* * *

Reaping Great Harvests of Metals

"Since the armistice, salvaging of metal on a large scale has been going on in all of the war areas of the west front," writes Commercial Attache Chauncey Depew Snow from Paris to the Bureau of Foreign and Domestic Commerce, Washington. "Thousands of tons of old iron have been salvaged from all the battlefields. A good share of this salvage work has been performed by the troops of the allied armies, but also a large amount of it has been done by the German prisoners of war.

"At practically all the railroad stations in the neighborhood of Etain and Bar-le-Duc, trainloads can be seen of the crooked, rusted barbed-wire entanglement rods, stacked up like cordwood, waiting for shipment. There are small mountains of miscellaneous scrap iron, and piles of heavy corrugated-iron sheets are a characteristic sight in salvaged dumps and railroad yards throughout the battle region.

"In the winter and spring just past German prisoners of war were going over the shell-shot battlefields which had been a part of the British front, tearing down the corrugated-iron shelters, picking up 'duds' or unexploded shells, clearing the thickets of barbed wire and chevaux de frise, storing and piling up all the salvaged metal in the dumps, and loading it on the freight cars and canal or river barges. In the salvage dumps you can see wrecks of camions, tanks of all descriptions, great piles of metal helmets, rifles, bayonets, knives, shells and shell cases, machine guns, and, in fact, all the metal debris of warfare, but the one lasting impression made on most observers is the acres of corrugated-iron sheets and barbed wire, and the twisted rods around which the barbed-wire entanglements had been made.

"In a good many areas the artillery fire has been so intense that the soil has been ruined for agricultural purposes. In such cases the salvaging is simply to remove the dangerous explosive agents, and recover the metal junk. In the agricultural districts, however, in cases where the shelling was comparatively light, and the land had been dug up to make trenches, the salvage work is closely tied up with that of agricultural reconstruction."

* * *

Our rural free-delivery system—the most expensive and least revenue-producing branch of the post-office—costs 1½ cents per piece of mail matter, and this 1½ cents is over and above the cost of collecting, sorting, handling, transporting and rehandling until it gets into the rural free-delivery carrier's wagon. This has all been done upon the American postal theory that the post-office function was a service to the American people and that the cheapness of postage was a benefit to the American home.—Senator Arthur Capper.

U. S. Postage Not Good in Canada

J. J. Stevens of the Stevens Co., Galt, Ont., Canada, writes us that "nine-tenths of the people in the United States that send stamped envelopes or post-cards, send them with United States postage on, which is, of course, not good on mails going out of Canada to the United States."

He asks us to call the attention of our readers to this condition, and advises that those who desire to inclose return postage for their replies take the trouble to secure Canadian post-cards or stamps.

Trade Currents from Cleveland and Chicago Districts

CLEVELAND LETTER

Machine-tool interests in the northern Ohio district were not disturbed by the possibilities emanating from a strike of steel workers throughout the nation. They admitted that were it to continue serious effect upon the business would be felt, as the machinery trade would be among the first to be forced to slow down, with other industries following as their needs for equipment and material became more extended.

During the week prior to the date set for the strike, the most significant effect noted in the industry was the greater scrambling of producing interests for screw stock, sheet material and the like, and a larger amount of material was absorbed than normal outlet would warrant. In several instances during the early threats of strike, several large material producing plants refused to take more new business, and in some instances refused to consider orders until the end of October at least.

SEPTEMBER NOT A FAVORABLE MONTH

There was no actual effect upon the machinery industry itself, however, when the strike order became public. The month of September has not been as favorable a one as was anticipated during the lull in hot weather, and the just-about-normal business continued, with small lots of equipment being absorbed on orders in an average proportion to inquiries received. Leading interests here admitted that only lack of material in the hands of manufacturers would prevent the latter from increasing their equipment.

Large manufacturing enterprises, however, have not stopped their plans. For example, the Torbensen Axle Co. has had plans prepared for an addition to its present plant here which will give it 15,000 sq.ft. additional operating space. This will be a 50 per cent. increase over the plant as it now is. The Cleveland Tractor Co. has taken 21 acres of land in the eastern manufacturing center of the city, which will be reserved for future development. This will give the Cleveland a tract of 125 acres for its production.

Probably the biggest development for the Middle West, affecting the machinery industry of the Cleveland district for this year, will be a fact within a few weeks when negotiations are expected to be completed for the incorporation of a mammoth automobile-body manufacturing concern. This is announced by leading interests which will be identified with the project, but names are being withheld until incorporation is completed. As far as the

machinery industry is concerned, however, the extent of the requirements of this firm will be realized, when it is stated that it is expected not less than 500 bodies will be made daily when the plant is in full operation. The new organization will be a $12,000,000 corporation.

Initial activities of the company will be confined to the production of a low-priced body, but later it may enter the higher-priced body field. Negotiations for a plant are now being made. At the outset it is planned to cater especially to automobile manufacturers now located in Cleveland, and, according to plans of the latter, the Cleveland district will provide a means of absorption of practically all the product of the new company.

Completion of this organization may mean that Cleveland will be the largest automobile-body producing center of the country. Already established body interests are expanding through new building, notably the Lang Body Co., the Brown Body Corp., the Rubay Co., the Theodore Kundtz Co., the Briggs Manufacturing Co. A prominent Detroit concern also is planning to locate in Cleveland.

Rumor has it that the proposed company will be a merger of existing companies. This is flatly denied by those in authority on the new project. There is, however, a merger pending of several large body-manufacturing companies, and it is hinted that Harry Shepler, former vice president of the Willys-Overland Co., Toledo, will head the new concern. So no actual steps toward merger have been made, according to local body company heads.

Automobile Companies Formed

The extent of the activities in this line, however, is shown by the large number of automobile companies that have been formed here in the last two years, and which are now producing cars. Among them are the Cleveland, the Grant, the Jordan, the Templar, and the Republic truck, which is preparing to make Cleveland its headquarters. Older firms in the motor-car industry include the Winton, the Stearns, the White, Chandler, and Baker R. & L. Co. All are going into quantity production on account of the demand.

Aside from this feature, the machinery industry here is not moving along with anything like the spectacular stride as anticipated for September. Inquiries are more numerous, but these are confined to standard equipment from interests who know just where to look for what they want. Most of these orders are for equipment to round out present shops, and are confined to small items. Machinery interests admit that while the situation might be much worse, it could be much better for this time of year. The bulk of business still comes from the automobile industry, which, from present indications, will make a maximum number of 1920 cars. Auto parts interests, of course, are interested in new equipment, but not to the extent expected of them. The big business is significant by its absence.

One outstanding feature at the moment is a sudden increase in interest in Brown & Sharpe automatic machines of Nos. 0 to 2.

Spanish Government May Get Harbor-Improvement Machinery

Sales of dredges, pile drivers and other machinery for use in harbor improvements and canal building probably will be arranged between the Spanish Government and the War Department, according to recent announcement. All equipment of that character in Europe has been disposed of to the French Government, but some of this machinery is among the surplus stocks in this country.

* * *

New Ammunition for Machine Guns

The War Department announces that it is necessary to develop new ammunition for machine guns which will have an effective range of not less than 3500 meters with an angle of departure of 15.5 deg. A small-arms station will be opened at Miami, Fla., for conducting experimental fire to determine maximum range.

Chicago Letter

A steady market with excellent business usually means a lack of news, and such is the condition in the Chicago machine-tool market today. While all the great corporations are marking time as they watch labor developments, the smaller manufacturers are buying with freedom. Tractor and automobile plants undoubtedly take the lead in the extent of their purchases, but by no means are alone, as almost every conceivable line which uses machine tools is so loaded up with orders as to be in need of additional equipment.

Local sales are curtailed by the continued lock-out in the building trades. There is a possibility of this trouble being settled soon. Orders from out of town are sufficiently heavy to cause dealers to forget shortage of local business, and almost without exception they are doing the best business of the year this month. Michigan, with its widely diversified industries, is furnishing the larger share of the business.

That the continued prosperity of dealers is being felt in increased business by manufacturers is evidenced by the fact that one large plant at West Pullman, Ill., devoted to the manufacture of machine tools, exclusively, is soon to have an addition to cost in the neighborhood of a million dollars. Contract for the erection has already been let. There have been no recent price changes of moment.

Personals

O. H. Root has severed his connections as secretary of the Kelly Reamer Co., Cleveland, Ohio, to accept another position.

William E. Kelly, president and general manager of the Kelly Reamer Co., Cleveland, Ohio, has retired from active management and has turned over his duties to J. M. Davie, assistant general manager.

Marion C. Mitchell has been appointed sales manager of the Sullivan Machinery Co. for the territory in Indiana and Illinois previously controlled from the St. Louis office, with temporary headquarters at Room No. 2006 Railway Exchange, St. Louis.

E. G. Bucknell, secretary and manager of sales of the Cleveland Twist Drill Co., has returned from a three months visit to England and the Continent where he has made a thorough trade investigation in conjunction with the European branch of the Cleveland Twist Drill Co. and the Cleveland Twist Drill Co. of Great Britain, Ltd., London.

Obituary

Martin H. Brennan, president of the E. J. Manville Machine Co., died at his residence in Waterbury, Conn., on Saturday, Sept. 6, 1919.

James Robert Fletcher, 52 years old, died at his home, West Main St., New Britain, Conn., following a brief illness with a complication of troubles. He was factory manager of the P. & F. Corbin Division of the American Hardware Corporation, having been identified with that concern for the past 12 years. For several years he was connected with the American Cash Register Co., and subsequently with the Yale & Towne Co., at Stamford. Burial will be in Fairview Cemetery.

Business Items

The United Electric Construction Co., Philadelphia, Penn., has announced the opening of its Cleveland office at 558-559 Hippodrome Annex.

W. K. Stamets, machinery merchant of Pittsburgh and Cleveland, has secured the agency for the Manufacturer's Equipment Co.'s line of air chucks, air collets, expanding mandrels and collapsible taps.

The Ajax Metal Co., Philadelphia, Penn., has recently opened a branch office in the Schofield Building, Cleveland, Ohio, with L. E. Purnell as district manager. Its office in Pittsburgh has been discontinued.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm in Spain desires to purchase screw-cutting engine lathes, back-geared power feed milling machines, machine tools of every description, small engineering tools, steel split pulleys, balata and leather belting, wood split pulleys, shafts for transmission of power, electrical and pneumatic tools, and grease cups and valves of every description. Correspondence may be in English. References. No. 30,411.

The president of a Spanish mining company is in the United States and is soon to return to Spain. He desires to purchase mining machinery, gasoline and kerosene engines, electric motors and equipment, and agricultural machinery. References. No. 30,498.

A Scandinavian firm desires to secure an agency for the sale of tools, motors, motor boats, electrical appliances, glass, and construction materials. Correspondence may be in English. Reference. No. 30,444.

A man from France who is in the United States for a short time wishes to purchase and secure an agency for the sale of vertical one-cylinder gasoline motors, developing from 3 to 9 hp., which are used for agricultural purposes, and high-tension magnetos for the motors. References. No. 30,457.

An agency is desired by a firm in Spain for the sale of electric conductors, electric machinery, material for central generating stations, small electrical material, pumps, turbines, internal combustion motors, and lamps. References. No. 30,475.

The purchase is desired by a man in Denmark of an automatic machine suitable for connection with an electric motor, for the manufacture of tin containers similar to that used by manufacturers of stick shaving soap. Correspondence may be in English. Reference. No. 30,469.

A merchant in Greece desires to be placed in communication with exporters with a view to securing an agency for the sale in the Near East of crude-oil engines (marine and land type), hydraulic presses, agricultural implements of all descriptions, flour-mill and oil-mill engines, steam engines, boilers, benzine and paraffin engines, motor cars and motor trucks, mechanical tools, blacksmith's machinery, electrical machinery of all kinds, electric wires, small refrigerator plants, and all kinds of manufactured goods. Correspondence may be in English. References. No. 30,454.

Transmission machinery for mining use, cables, wheelbarrows, mining cars, mining tools, pumps, compressors, punching machines, metal sheets, metal construction material, such as elbows, arches, and beams, are required by a firm in Spain. Quotations should be given c.i.f. Spanish port or f.o.b. New York. Terms, cash against documents, but short-term acceptance is recommended. References. No. 30,151.

The purchase is desired by a firm in India of complete rubber tire and tube manufacturing machinery, hardware, and mill stores, machinery, and machine tools of all kinds. Quotations should be given c.i.f. place of destination. Terms, cash against documents. Reference. No. 30,112.

Trade Catalogs

Electrical Precipitation. Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn. Circular; No. 7375; 8¼ x 11 in.; pp. 23. An interesting circular of the recovery of valuable material from smoke and gases. Any one may receive a copy of this upon request.

How Thermit Healed My Broken Jaw. The Metal and Thermit Corporation, New York, N. Y. A folder which illustrates the operations involved in making a Thermit weld on a 13½-ton broken upper jaw of an alligator shear used by Jos. Joseph & Bros. Co., Modena, Penn. The break welded was 80 in. in length and varied from 4½ to 23 in. in thickness.

A Study of Various Types of Belting by Ernest D. Wilson. The information contained in this pamphlet was obtained during the course of an investigation on power transmission by belting, which was conducted by the Mellon Institute of Industrial Research of the University of Pittsburgh for the Leather Belting Exchange.

Black Enamels and Japans. Hilo Varnish Corporation, Brooklyn, N. Y. Bulletin No. 1; 8 x 5 in.; pp. 21. This bulletin describes how black enamels and japans can be used to give satisfactory results; also a list of articles of wood and metals and the materials which should be used.

Taft-Peirce Standard Products. Taft-Peirce Manufacturing Co., Woonsocket, R. I. A 31-page booklet of the products and their prices of the Taft-Peirce Manufacturing Co.

Autogenous Welding. Davis-Bournonville Co., Jersey City, N. J. House Organ; 6 x 9 in.; pp. 32. This is called the Victory number, publication having been suspended during the war. Contains a number of interesting articles on the war use of oxy-acetylene apparatus, as well as other information.

Pangborn Service. Pangborn Corp., sandblast specialties, Hagerstown, Md. This circular shows a number of letters, dating from 1912 to 1919, from manufacturers, regarding the Pangborn sandblast equipment and their dealings with the corporation.

Prospectus of Apprenticeship. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Bulletin No. 138; pp. 26; 6½ x 5½ in. This booklet is intended to be of benefit to the boy who is ambitious, and who is desiring to obtain a degree, or to learn a trade. This school is maintained by the municipality in which the apprentice resides and is under the direct supervision of the Industrial Commission of Wisconsin. Application blanks and rates paid in the several courses will be sent upon request.

Marine Engines and Power Machinery. Robert Weterill & Co., Chester, Penn. A catalog, 10½ x 8 in., of photographs illustrating its engines, machine construction and designs; also its erecting department and foundry.

Gates Rock and Ore Breaker. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. A folder giving a general description and showing the development of the Gates rock breaker; large illustrated bulletins on this subject will be sent upon request.

Perforated Metal. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Bulletin No. 4014; 6 x 3 in. This bulletin describes the use of perforated metal.

Power Presses, Cold Headers, Edging Lathes and Buffing Machines. The Atlas Machine Co., Waterbury, Conn. Four 4-page folders describing the company's various machines; also giving complete specifications.

Hydraulic Marking Machine No. 12. Martin Machine Co., Greenfield, Mass. A single-page circular describing the operations of the marking machine; specifications included.

Crushing Rolls. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Bulletin No. 1816; pp. 15; 6 x 10½ in. This bulletin describes and illustrates briefly crushing rolls of various designs, also giving dimensions of the sizes in which they are manufactured.

Morey & Co., Inc., 50 Church St., New York. Catalog; pp. 16. This covers a list of new and used machine tools for July, 1919. The company makes a specialty of buying for cash standard used metal working and woodworking machinery, electric motors and other allied equipment, including either complete industrial plants or single tools. Copies of list gladly mailed upon request.

Centrifugal Pumps. The Earle Gear and Machine Co., Wayne Junction, Philadelphia, Penn. Catalog; pp. 8; 9 x 6 in. A catalog illustrating and describing the construction and advancements of the centrifugal pump.

Electric Dynamometers. Sprague Electric Works of the General Electric Co., 527-531 West 34th St., New York City. Bulletin No. 48701-A, pp. 11; 8 x 10½ in. This bulletin is devoted especially to the Sprague electric dynamometers as applied to laboratory and production testing of automobile truck, tractor, airplane and marine gasoline and kerosene engines.

C-H Electric Soldering Irons. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. An eight-page folder which illustrates and describes the standard sizes of electric hand-soldering irons.

New Publications

Exercises in Gothic Lettering (Vest Pocket Series). By William C. Bruce. Two booklets, 32 pages each; 5 x 2½ in. Published by the Bruce Publishing Co., Milwaukee, Wis.

These two booklets on vertical gothic and slant gothic have been evolved as the result of the author's many years experience as a teacher of mechanical drawing. The instructions are clear and concise, all unnecessary text being eliminated. They will be found helpful in teaching rapid, neat lettering, in which respect present-day teaching is deficient.

Metal Worker's Handy Book of Receipts and Processes. By William T. Brannt with additions by P. L. Tea. Five hundred and eighty-two 4⅝ x 7⅝-in. pages; seventy-nine illustrations. Published by Henry Carey Baird & Co., Inc., 116 Nassau St., New York City.

This is practically a reprint of Brannt's book of old receipts which was published years ago, to which Mr. Tea has added approximately 60 pages of material on oxy-acetylene, thermit and electric welding, galvanizing, die casting, etc.

The Construction of Graphical Charts. By John B. Peddle. One hundred and fifty-eight 6 x 9-in. pages; 79 illustrations. Second edition. Published by the McGraw-Hill Book Co., 239 West 39th St., New York.

This book scarcely needs an introduction to our readers, but many will welcome the new edition to which has been added some valuable data on chart construction which the author has found to be extremely useful in his own work. Anyone with the ordinary knowledge of mathematics which every engineer should possess can understand and apply the process with but little difficulty.

Forthcoming Meetings

The American Bankers' Association will hold its 45th annual convention in St. Louis, Sept. 29 to Oct. 2.

The American Mining Congress will hold its 22nd annual convention in St. Louis, Nov. 17-21.

Boston Branch, National Metal Trades Association. Monthly meeting on first Wednesday of each month, alternating with the Employers' Association of eastern Massachusetts. George D. Berry, secretary, room 50-51, 166 Devonshire St., Boston, Mass.

Electric Hoist Manufacturers' Association. Monthly meeting at the offices of the Yale & Towne Manufacturing Co., 9 East 40th St., New York City. Secretary W. C. Briggs, Shepard Electric Crane and Hoist Co.

Engineers' Club of Philadelphia. Regular meeting the third Tuesday of the month. Lewis H. Kenney is the chairman of committee on papers.

Engineers Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

The International Trade Conference called by the Chamber of Commerce of the United States will be held in Atlantic City on Sept. 30 to Oct. 6. Homer L. Ferguson is the president of the National Chamber and A. C. Bedford is the chairman of the executive committee of the conference.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn., Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Rochester Society of Technical Draftsmen. Monthly meeting last Thursday. O. L. Angevine, Jr., secretary, 547 Arnett Boulevard, Rochester, N. Y.

The National Machine Tool Builders' Association will hold its annual convention at the Hotel Astor, New York City, Oct. 15 and 16. Chas. E. Hildreth, Worcester, Mass., is general manager, and C. Wood Walter, Cincinnati, Ohio, is secretary.

The National Safety Council will hold its eighth annual Safety Congress in Cleveland Oct. 1 to 4 at Hotel Statler.

MACHINE TOOLS WANTED

D. C., Washington—The Bureau of Supplies and Accounts, Navy Department, will soon receive bids for furnishing machine tools as follows:

Schedule No. 4414, miscellaneous clamps, anvils, saw swages, shapers, etc.; 1 gang edger motor-driven; 1 cutoff swing-saw and 1 band-saw sharpener, delivery Mare Island, Cal.

Schedule No. 4426, 1 bolt-threading machine, motor-driven, delivery Brooklyn, N. Y.

Schedule No. 4427, 1 bar iron shear for shearing rivets, delivery Brooklyn, N. Y.

Schedule No. 4488, 1 left-hand vertical, band resaw, delivery Norfolk, Va.

Schedule No. 4497, 4 chuck columns; one 30 in., one 85 and one 12 in. cylinder-boring machines; 1 pipe-threading machine; 2 metal band saws and 2 electric welders, delivery Pudget Sound, Wash.

Schedule No. 4505, 2 turret lathes, delivery Puget Sound, Wash.

Schedule No. 4506, one 8 in., power hacksaw, motor-driven; four in., bench, hand, arbor presses; one 36 in. power, arbor press and 2 cutting, cold saws, motor-driven, delivery Puget Sound, Wash.

Schedule 4507, one 10 in. sensitive, bench drill; one 1-spindle centering machine and 3 precision lathes, motor-driven, delivery Puget Sound, Wash.

Schedule No. 4508, miscellaneous radial drills, motor-driven and six 28, 22½ and 18 in. upright drill presses, motor-driven, delivery Puget Sound, Wash.

Schedule No. 4509, 1 double bench grinder; miscellaneous wet and dry grinders, motor-driven and 2 double buffing machines, motor-driven, delivery Puget Sound, Wash.

Schedule No. 4510, 1 Universal grinding machine, delivery Puget Sound, Wash.

Schedule No. 4519, 6 Universal milling machines, delivery Puget Sound, Wash.

Schedule No. 4520, one 36 in. gear-cutting machine and one 10 in. crank slotter, delivery to Puget Sound, Wash.

Schedule No. 4521, 21 engine lathes, motor-driven; 2 extension, gap lathes and 1 toolmakers' lathe, delivery Puget Sound, Wash.

Schedule No. 4522, 2 vertical boring mills; 2 vertical turret lathes and 2 planers, motor-driven, delivery Puget Sound, Wash.

Schedule No. 4523, two 16 in. and two 24 in. crank shapers, delivery Puget Sound, Wash.

Schedule No. 4524, 2 horizontal boring machines, delivery Puget Sound, Wash.

Schedule No. 4528, 1 oilstone grinder, motor-driven; one 24 in. jointer, motor-driven; two 8 in. bench jointers, motor-driven; one 30 in. sanding-disk machine; miscellaneous mortisers and borers, motor-driven; 2 pattern makers' lathes; one 38 in. band saw; 1 double spindle shaper; 1 single cylinder surfacer; one 26 in. saw table, motor-driven; one 15 in. portable, wood-floor trimmer and two 8½ in. wood, bench trimmers, delivery Puget Sound, Wash.

Schedule No. 4534, one 48 in. cornice brake; 1 bench crimper and beader; one 200 lb. steam hammer; one 37 in. slip-roll, forming machine; 1 Universal plate machine; one 200 ton forging press; one ½ x 7½ in. hand punch; one 30 in. single-end, vertical punch; 1 bending roll, motor-driven; 1 circular bench shear; one ⅜ x 6½ in. hand shear; one 37 in. power squaring shear and one 30 in. single vertical shear, delivery Puget Sound, Wash.

D. C., Washington—A. L. Flint, Purchasing Agent for the Panama Canal, Washington, will receive bids until Oct. 7, for furnishing one hundred forty-four 14 in., wooden handle; sixty 24 in. steel handle and thirty 36 in. steel handle, Stillson wrenches, drop-forged steel parts, jaws to have machine-cut teeth, hardened and tempered. Also 36 frames and 72 jaws for 8 in. wrench; 120 jaws for 14 in. wrench and 120 jaws for 24 in. wrench.

Five hundred seventy-six 8 in. flat bastard; seven hundred twenty 12 in., flat smooth; sixty 10 in. half-round, 2nd cut; three hundred sixty 12 in., flat mill, 2nd cut, 1 round edge and two hundred sixteen 6 in. square bastard files.

Fifty ¼ in.; fifty ⅜ in.; fifty ½ in.; fifty ⅝ in.; twenty-four ¾ in. and twelve 1 in. wrought-iron, galvanized, hook and eye open turnbuckles, right and left-hand thread, similar to figure 322 A, page 236, C. D. Durkee & Co.'s catalogue of Marine Hardware. Fifty ¼ in.; fifty ⅜ in.; fifty ½ in.; twenty-four ¾ in. and twelve 1 in. eye and eye turnbuckles, similar to figure 322 C, page 236. Fifty ¼ in.; fifty ⅜ in., fifty ½ in., fifty ⅝ in., twenty-four ¾ in., and twelve 1 in., hook and hook turnbuckles, similar to figure 322 B, page 236; twelve ⅞ in.; twelve 1 in.; twelve 1¼ in.; twelve 1½ in.; twelve 1⅞ in. and twelve 2 in. shackle and shackle turnbuckles, similar to figure 322 E, page 236.

Nine upright drills, blacksmith's or post, for half round ½ in. shank bits, equal to No. 93¼, Simmons Hardware Co.' catalogue.

Twenty-four thousand 12 in. soft back, hand hack-saw blades, 14 teeth to the inch.

The following concerns are in the market for machinery and machine tools.

Md., Cambridge—The P. M. Bramble Co.—canning machinery.

N. Y., Jamestown—W. A. Ballard—a 10 x 46 in. star lathe (used).

N. Y., New York (Borough of Manhattan)—D. Auerbach & Son, 11th Ave. and 46th St. are interested in manufacturers of machinery to crush lumps 16 in. in diameter and 2 in. thick.

N. Y., New York (Borough of Manhattan)—Runeberg & Schultz, 120 Liberty St., for export—1 planer for 25 ft. plates 1½ in. thick, preferably with motor, 500 v., 50 cycle, 3 ph. and 1 Acme 1 in. bolt press (used).

N. Y., New York (Borough of Manhattan)—Wonham, Bates & Good, Inc., 17 Battery Pl. are interested in manufacturers of machinery for making expanded metal.

N. Y., Oneonta—The Boston Candy Kitchen, 156 Main St., is interested in manufacturers of olive pressing machines. Address W. Georgeson.

N. Y., Rochester—The Kellogg Manufacturing Co., 3 Circle St.—1 No. 5 A Potter & Johnson screw machine and 2 Warner & Swasey screw machines (used).

Penn., Beaver Falls—P. Pettler and Sons—a 5 to 7 in. drilling machine.

Penn., Philadelphia—J. Mason, 1486 Widener Bldg.—18 and 22 in. lathes and oil burning furnaces.

La., New Orleans—R. Stowell, 725 Whitney-Central Bldg.—one 30 in. x 12 or 18 ft. lathe; 1 Universal milling machine, No. 2 Cincinnati, or equal; 2 upright drill presses, 30 to 40 in. swing and one 100 to 150 ton hydraulic wheel press.

N. C., Wilmington—The Broadfoot Iron Works, Inc.—1 lathe for locomotive drive wheels, 10 ft. between centers, 60 in. swing; a Universal milling machine and a key-seating machine (new or used).

Tenn., Chattanooga—The Chattanooga Machinery Co.—a 4 ft. plain radial drill (used).

Tenn., Chattanooga—W. E. Mills, James Bldg.—1 power punch with 36 in. throat and 1 set bending rolls to bend 8 in. sheet.

Ill., Chicago—The Chicago and Northwestern Ry.—three 24 in. shaping machines, motor or belt drive; one 24 in. crank shaper; one 24 in. slotting machine; one 51 in. boring and turning mill; two 48 in. car wheel boring machines; 1 set bending rolls, for ¾ in. plates, 10 ft. between centers; one 26 x 8 in. lathe; one 400 ton double end hydraulic car wheel press; 1 pneumatic flanging machine and miscellaneous light equipment for handling sheet metal work (new).

Ill., Chicago—The E. L. Essley Machinery Co., 555 West Washington St.—a 200 lb. Bradley rubber cushioned helve hammer.

Mich., Ann Arbor—The Economy Boiler Co.—a heavy duty radial drill; a medium sized gear cutter; a rotary shear for ¼ in. plate and a 42 in. boring mill (new or used).

Mich., Flint—The Board of Education—wood-working and machine shop tools.

Ohio, Akron—The Goodyear Tire and Rubber Co., Market St.—one 4 in. and one 12 in. pipe machines (new).

Ohio, Bucyrus—The Bucyrus Copper Kettle Works—a 16 in. shaper (used).

Ohio, Canton—The Holmes Automobile Co., Winfield Way, N. E.—about $8000 worth of machine tools.

Ohio, Cleveland—The Aetna Brass Manufacturing Co., 1635 East 55th St.—several polishing lathes (used).

Ohio, Cleveland—The Fixit Body and Fender Co., 2117 East 55th St.—a 36 in. band saw with motor.

Ohio, Cleveland—The Independent Brick and Tire Co., Dennison Ave. and West 73rd St.—brick-making machinery.

Ohio, Cleveland—The Kilby Manufacturing Co., 4623 Lakeside Ave.—a boring mill, 7 ft. or more under cross rail (used).

Ohio, Cleveland—The Ohio Pottery and Glass Co., 5211 Euclid Ave.—a Cleveland full automatic machine, with 2⅜, 3¼ and 3⅞ in. chuck capacities; one 6 in. and one 11 in. Gleason double gear generators; 1 La Pointe and 1 Cincinnati broaching machine and 1 Landis bolt threader.

Ohio, Springfield—C. E. Lawson—a cylinder grinder and an engine lathe (new or used).

Ind., Evansville—The New Process Vulcanizing Co., 28-210 Upper 5th Ave., one small surface grinder, using wheels not larger than 4 in., having a table approximately 4 x 14 in., which may be raised at least 4 in.; one small power rapid non-rotating riveting hammer, preferably bench type; one small foot power die press of not over 300 lb.—(used).

Kan., Topeka—The Piersen Telegraph Transmitter Co.—a tool room drill up to ½ in. capacity.

Mo., St. Louis—The American Brake Co., 1924 South 2nd St.—machine tools for the manufacture of brakes. Address the Purchasing Agent.

Mo., St. Louis—The O. E. Haupt Motor Co., Olive and Whittier St.—lathes, etc., for its automobile repair shop. Address O. E. Haupt, Pres.

Mo., St. Louis—The Kardell Tractor and Truck Co., Broadway and Loughborough Ave.—milling, foundry machinery, etc., for the manufacture of farm tractors. H. W. Kardell, Pres.

Mo., St. Louis—The Standard Fabricating Co., Syndicate Trust Bldg.—lathes, dies and stamping machinery. Address the Secretary.

Tex., Houston—The Mack Manufacturing Co., 821 Kress Bldg., forge shop equipment: 3 steam hammers, furnaces, forges and cranes, foundry equipment, 2 side blow cupolas, floor machinery, one 10-15 ton bridge crane, one 7½ ton yard crane, 100 ft. span; machine shop equipment, 10 special lathes for oil field specialties, 3 turret lathes, several boring mills, shapers, etc. C. F. Searls.

Okla., Sand Springs—A. H. Kerr & Co.—an 8 x 20 in. quick change engine lathe, double back geared with taper attachment (new).